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USSR Report

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No 10, OCTOBER 1986

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USA: Economics, Politics, Ideology

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DANGER OF NUCLEAR WAR BEING STARTED BY ACCIDENT

Moscow SSHA: EKONOMIKA, POLITIKA, IDEOLOGIYA in Russian No 10, Oct 86 (signed to press 15 Sep 86) pp 3-13

[Article by M. A. Milshteyn: "On the Threat of an Accidental Outbreak of Nuclear War"]

[Text] A number of technical accidents in the past year have again--and with particular force--attracted the attention of scientists and public and political figures in the West and the East, including the USSR and the United States, to the danger of an accidental and unauthorized use of nuclear weapons and to the unpredictable consequences associated with this.

Let us briefly recall some of these incidents. On 28 January 1986 the American shuttle "Challenger" exploded off Cape Canaveral after takeoff from the launch pad, resulting in the death of seven American astronauts. On 3 April, an American "Delta" rocket, which was considered one of the most reliable rockets of its kind, exploded 91 seconds after its launch. On 18 April a "Titan 34-D" delivery vehicle, which was supposed to put into orbit a new reconnaissance satellite with very complex and expensive apparatus, exploded soon after takeoff in the vicinity of Vandenberg Air Base (California). On 31 May an "Ariane" rocket with a television communication satellite on board had an accident after its launch from the French space center in Kourou (French Guiana).

One cannot, of course, fail to mention the accident at the Chernobyl AES on 26 April. However, in so doing one must stress that the consequences of this accident, as well as of the others that took place at American, British, West German and other nuclear power stations (more than 370 reactors now operate in various countries), are nothing compared to what could happen due to an explosion of even the smallest, by today's standards, nuclear bomb. After all, as you know, hundreds of thousands of nuclear weapons are stockpiled in the world, each one capable of producing a catastrophe whose scale is simply impossible to imagine.

According to the well-known British scientist F. Barnaby, former director of the Stockholm International Peace Research Institute, mankind is "constantly under the threat of nuclear war as a result of an accident."[1] In 1965-1977, as the Pentagon admits, 381 nuclear weapons-related incidents occurred in the

United States; 33 serious accidents occurred in 1980 (later data has not been published). Moreover, most incidents occur in the American Navy (they call a particularly dangerous incident "Broken Arrow," a less significant one "Bent Spear" and all others "capable of producing a serious threat" are codenamed "Dull Sword).

A public opinion poll conducted in the United States in winter 1985 by the Public Agenda Foundation showed that more than two-thirds of its participants (69 percent) thought that a nuclear war would mostly likely begin due to technical or human error--a miscalculations, a wrong assessment of a situation--or due to the escalation of a conventional conflict. Only 24 percent were of the opinion that a deliberate nuclear attack by one side against the other would be the cause of war.

The possibility of the accidental or unauthorized use of nuclear weapons is not, of course, restricted to accidents or to incidents that occur with them. Under present conditions it is significantly broader, more complicated and more diverse. This problem arose long ago, essentially together with the appearance of nuclear weapons and their delivery systems. The danger of their accidental or unauthorized use continuously increased due to the proliferation of the number of nuclear weapons, their constant qualitative refinement and the appearance of new delivery systems, primarily ICBM's and SLBM's with a flight speed reaching 24,000 km per hour.[2] This speed decisively and irrevocably altered the significant of the time factor. It became catastrophically short for collecting data, comprehensively analyzing and assessing it, and for valid and rational decisionmaking. D. Krieger, president of the American foundation, "The World in the Nuclear Age," writes: "If at the beginning of the appearance of nuclear weapons a warning about the possibility of a nuclear attack could be obtained within 10-12 hours, today this time has been reduced to 6-8 minutes in Europe and less than 30 minutes in the case of the use of intercontinental systems in an attack."[3]

D. Ford writes about this in his book "The Button. The Pentagon's Strategic Command and Control System": "In the 1980's there is no more guaranteed time for consultations via a direct communications link, as there was during the time of bombers that approached each other's territory at subsonic speeds. The technology has changed. Now intercontinental missiles fly at a speed exceeding 15,000 miles per hour."[4]

As a result, there has been a broad influx of various electronic apparatus into the decisionmaking process, and where at one time human reason completely predominated by rights, complex equipment, automatic machines and computers have appeared that are designed to replace man, because the shortage of time does not allow him to cope by himself. Thus, man is gradually becoming more and more a prisoner of the technology he himself invented.

The statement of an international conference of scientists and experts on the danger of the accidental outbreak of war held at the end of May 1986 in Vancouver (Canada) reached the conclusion that this danger has increased significantly lately. According to participants in the conference, it is intensified for many reasons and, in particular, in connection with the

deterioration of the general international political situation, which has taken place against the backdrop of a lack of progress at various arms limitation talks. The danger has increased of a wrong interpretation of signals toward a "worst case" and of wrong reactions to these signals, inter alia because the arms race has led to the creation and deployment of destabilizing weapons systems and the development of destabilizing technology (the participants had in mind, among other things, everything associated with SDI). Particular attention was paid to the complicated command, control and early warning system in conditions of the constant reduction of time for assessing information and making rational decisions.

An extremely complicated and multilayered early warning system exists and is being constantly refined in the United States. The Reagan Administration has already released 30-40 billion dollars to modernize this system.[5]

By using various technical means of detection, the early warning is aimed at promptly giving a signal to the U.S. political and military leadership about a ballistic missile attack by the Soviet Union. It is hardly necessary to stress that an attack is not only not being planned but has never been planned by the Soviet Union, and that it contracts its peaceful policy and defensive military doctrine. The Soviet Union, as you know, has unilaterally pledged not to be the first to use nuclear weapons. The United States refuses to do the same.

Nonetheless, the American early warning system is constantly in operation, and the main thing is that it makes quite a few technical errors, which produce false alarms that could ultimately put the world on the brink of a thermonuclear catastrophe.

Relatively speaking, this system consists of three basic components. The first comprises three surveillance satellites located in a geosynchronous orbit, which are designed to acquire a fix on launches of ballistic missiles with the help of infrared sensors. One of these satellites is deployed over the Indian Ocean, and the other two--over the Pacific and Atlantic oceans. Early warning satellites are replaced approximately every 3 years. Besides them, the United States has a few dozen various military satellites--communications, photographic and electronic reconnaissance, navigational, meteorological and others--in constant orbit. The main ground control point for all these satellites is located in Sunnyvale (California). Outer space surveillance is not that easy in contemporary conditions. At present, according to some estimates, more than 5,000 various objects, including satellites, the fragments of satellites and rockets that have ceased their activity and so on, are located there.

At first the data obtained from the early warning satellite over the Indian Ocean are transmitted, for technical reasons, to an American ground station codenamed "Casino," which is deployed in Narrangar (South Australia), and from there, after computer processing, they are sent to the United States.[6] Data from satellites over the Pacific and Atlantic oceans are transmitted directly to ground stations in the United States.

Another component--an early warning system for ballistic missiles (Ballistic Missile Early Warning System--BMEWS)--consists of three large radar stations designed to detect (at a distance of about 5,000 km) and warn about ICBM's flying toward North America, Europe and Great Britain. They are located in Thule (Greenland), in Clear (Alaska) and at Fylingdales Moor (Great Britain). Radar stations are on continuous alert to scan, detect and track any ICBM launched from USSR territory. At present, a substantial modernization of these radar stations is under way (first in Thule and then in Clear and Fylingdales Moor), which affects computers, displays, communication equipment and the radars themselves. One must mention that this modernization is being carried out contrary to the provisions of the Soviet-American ABM Treaty, which permits the deployment of these types of radar stations only on the periphery of a national territory. Despite frequent representations to the American side in connection with the aforesaid radars, the latter has not stopped this work, particularly in Thule.

"Pave Paws" phased-array radars are used for spotting ICBM launches (the third component). Two of them have already been commissioned--at the U.S. Air Force bases in Otis (Massachusetts) and Beale (California). Another two are in the process of construction near the air bases of Goodfellow (Texas) and Robbins (Georgia) and will be commissioned in 1987. Incidentally, the parameters of "Pave Paws" radars are practically no different from the parameters of ABM radars and they can thus be used not only for early detection purposes but also for ABM defense, which also goes against the aforementioned treaty.

The early detection system should be assessed in close association with the command and control system for strategic nuclear forces, where all the information accumulates for it to assess and make decisions on the use of these forces. It consists of a number of main elements. They are, first of all, the so-called National Military Command Center (NMCC), which was created as early as 1962 and is situated in the Pentagon. All basic American military communications are concentrated here. It is controlled by the Joint Chiefs of Staff and is the center from which orders on the use of nuclear forces can be given. All processed data from technical warning systems go there. It is precisely from here that information is forwarded to the White House, where the War Room is located, which receives data not only from the NMCC but also from the National Security Agency, the CIA and so on.

Other components are the Strategic Air Command (SAC), which has its headquarters near the city of Omaha in Nebraska, to which strategic nuclear forces are subordinate, and the headquarters of the North American Aerospace Defense Command (NORAD), which is located in the mountains near Colorado Springs. Urgent orders from the NMCC are conveyed to these components through the so-called primary alerting system, comprising various duplicate lines of communication--telephone, television and closed channel communications using satellites. Within the NORAD system there is also an early warning center which receives data from technical warning systems (satellites, radars and so on). As opposed to SAC, which has command functions, NORAD is the main point for the collection, processing and transmission of information. The division of functions between them is relative and, in particular, boils down

to NORAD responsibility for timely warning, and SAC responsibility for timely alert.[7]

It is believed that early warning satellites acquire a fix on missiles 1-2 minutes after launch. The information obtained is immediately (within 30 seconds) transmitted to the four main command centers--NORAD, SAC, NMCC and the Alternate Military Center--and is analyzed within 3 minutes. If the information obtained is assessed as a potential threat, a so-called missile threat conference (missile display conference--MDC) lasting 2-3 minutes is convened on display units, in which representatives of the three main command centers take part. The further plan of action presupposes the following: If the NORAD commander believes that the additional data confirm the reality of a threat, a threat assessment conference (TAC) is organized on the same basis. It is convened 30 seconds after the first conference and lasts from 30 seconds to 2 minutes. If this conference also acknowledges that the danger is real, a third conference is convened 30 seconds after it on carrying out a nuclear strike (missile attack conference--MAC). It is planned that the entire supreme command, including the President, would take part in it and that a nuclear strike could be carried out immediately after its conclusion.[8]

This, in short, is the layout of early detection and warning, of the command structure and of the methods of decisionmaking on the use of nuclear forces. Of course, it gives only an approximate, but at the same time necessary, idea about where and how failures and miscalculations could occur. It is true that the representatives of the American command themselves have a very high opinion of the reliability of their system. For instance, one of the NORAD leaders stated: "I have confidence in our system of sensors, our computers, our people, our operational procedures and, therefore, I am 100-percent certain in my assessment of the information obtained."[9]

However, he did not mention the fact that the greater the incorporation of modern equipment in early warning systems and the more complicated this system becomes, the more failures and errors occur in the assessment and receipt of information. He also did not mention that the entire structure of the American command system and its operation is designed not to make a retaliatory, but primarily a first, strike. "The system of communications and control established two decades ago," D. Ford testifies, "is designed to transmit the necessary instructions and orders on the targets and times for making a first strike."[10] This cannot fail to have an impact on the analysis of certain information.

O. Palme, opening a Stockholm conference of scientists and specialists on the topic "Nuclear War by Mistake--Inevitable or Preventable?" said: "Those who today bear responsibility for a very complicated nuclear system are apparently quite certain that these systems are in reliable hands, are being reliably controlled, and that technical systems by themselves cannot produce an unthinkable outcome--nuclear war. Technical specialists are even certain that they completely exclude the possibility of human error." He then added that "past experience shows that no equipment is perfect and that it does not always carry out the orders of its creators."[11]

Table 1 gives some idea of the frequency of false alarms and conferences conducted in the United States on the basis of information obtained by early warning facilities. Altogether, there were 1,152 false alarms in 8 years, from 1977 to 1984, or an average of 12 a month, and in 1983 there were more than 20 of them per month.[12]

As has already been mentioned, all of this began long ago. It is known, for instance, that as early as the beginning of the 1950's a flight of wild geese was mistaken by the early warning system for Soviet nuclear bombers approaching American territory. In 1960 a shower of meteorites placed the early warning system of alert and was mistaken by the NORAD command for a missile attack on U.S. territory.[13]

Table 1

Years	Number of MDC's	Number of TAC's
1977	43	0
1978	70	2
1979	78	2
1980	149	2
1981	186	0
1982	218	0
1983	255	0
1984	153	0

Source: "The Nuclear Time Bomb," p 109.

As has already been mentioned, with the increase in the quantity of sensors and computers, the number of false alarms grew and they became more dangerous. Two false alarms in 1979 and 1980--both within NORAD--had serious consequences. In the first case, as a result of an error by a duty officer, a signal was transmitted that the United States was supposedly being threatened by a nuclear strike. This led to strategic aviation taking to the air. Moreover, ICBM's and SLBM's were put on the highest level of readiness. In the second case, in the early morning of 3 June 1980 a computer of the complex NORAD system sent an alert signal to the SAC that indicated that a fix had been acquired on two Soviet SLBM's that were supposedly on their way to the United States. In another 18 seconds NORAD reported that other missiles were also in flight and moving in the same direction. Signals were then received about the beginning of a massive launch of Soviet ground-based ICBM's. About 100 U.S. bombers carrying nuclear weapons were ready for take-off as well as the presidential airborne command center. The airborne command center of the Pacific Ocean commander actually took to the air. In the end everything returned to normal and it turned out that this false alarm was sounded due to an error by a computer chip (a small part worth 46 cents that is manufactured in Taiwan).[14]

Here one should bear in mind that not all cases are discussed and not all data on them are published. According to a Pentagon representative, "documents on this score, which formerly had a 'secret' classification, are now classified

'top secret.'"[15] It is known only that from January 1978 to May 1983 the number of false alarms in the NORAD system alone increased by 32 percent a year, and now an average of four to five alerts are declared weekly. But the Reagan Administration still continues to invest huge sums in the further automation of the command and early warning system.

The threatof an accidental or unauthorized use of nuclear weapons is many-sided and is not restricted only to technical failures, computer errors and so on. One should also not forget about the danger associated with the human factor.

Alcoholism, drug addiction and various mental illnesses are widespread in the U.S. Army, including among servicemen who deal with nuclear weapons. It is believed that about 5-6 percent of all personnel of the American Armed Forces have direct access to the control of nuclear weapons. And "the greater the number of nuclear weapons placed in service and the more the framework of their geographical deployment is expanded," Texas University Professor L. Dumas notes, "the more people take part in control over them. As a result, the probability of human error, which could lead to catastrophic consequences, increases."[16]

A special program has been adopted within the Pentagon system for checking the reliability of nuclear forces personnel (personal reliability program), aimed at denying people, who for various reasons cannot be trusted to serve in the forces, access to nuclear weapons. These checks are conducted regularly. Some data for 1975-1977, when the checks encompassed more than 100,000 American servicemen, are cited in Table 2.

Table 2

Number of Persons Dismissed from Units and Subunits Having Nuclear Weapons

Reasons	1975	1976	1977
Alcoholism	169	184	256
Drug addiction	1,970	1,474	1,365
Negligent attitude toward duties	703	737	828
Convicted by a military tribunal or civilian court	345	388	350
Unlawful behavior or actions	722	945	885
Mental illness	1,219	1,238	1,289
Total	5,128	4,966	4,973

Source: THE BULLETIN OF THE ATOMIC SCIENTISTS, November 1980, p 16.

Table 2 testifies that annually about 5,000 American servicemen having access to nuclear weapons are dismissed or transferred to other jobs, but this is done after they have already taken part for some time and to some extent in the control of nuclear weapons.

From time to time the American press publishes reports confirming the statistics cited.

A program of the American NBC television company reported in August 1986 that "among servicemen in the American Army guarding nuclear weapons in various parts of the country there were drug addicts and mentally unstable individuals as well as convicted criminals. A study conducted in the army showed that under these conditions there is a great risk of the theft of nuclear weapons by terrorists."

So as to exclude the possibility of the unauthorized use of nuclear weapons, as early as the 1960's so-called electronic locking devices or "permissive action links" were installed on tactical nuclear weapons. Similar "locks" are also installed on strategic weapons. They are being systematically updated.[17] It is believed that a secret coded signal must be given for the use of weapons. Special systems built into weapons are designed to prevent any attempt to act in circumvention of "permissive action links."

The order to launch is given on behalf of the President or by the President himself in a coded form and must be decoded by two officers. The decoding procedures are kept in two separate safes. Each officer has access only to his own safe. After they are both convinced of the accuracy of the order, each inserts a key into his own safe. Moreover, it is envisaged that the keys must be turned simultaneously.[18]

Thus, the possibility of an unauthorized launch of nuclear weapons seems to be theoretically excluded. However, in reality this is not so. More than half of all strategic weapons are essentially not equipped with electronic locks. For instance, nuclear weapons on submarines, which have more than 5,000 of these weapons, do not have "permissive action links." And U.S. submarines do not have any technical systems at all that could prevent the possibility of a willful launch of ballistic missiles. At a given moment two people (the radio operator and the captain) on board an American nuclear submarine could launch the ballistic missiles installed on it, which are capable of causing such terrible destruction that the consequences cannot be foreseen.

Therefore, the danger of an unauthorized launch really exists, and this must be taken into account.

There is no need to mention the fact that this threat could sharply intensify if the American "Star Wars" plans were to be implemented, and that a new and extremely dangerous round of the arms race--in space--would begin. The goal of these plans, as you know, is to have an opportunity to make a first nuclear strike and to make it with impunity. Their implementation would increase the risk of the outbreak of nuclear war, would destabilize the strategic situation and would enhance the level of distrust between our countries. All this, in turn, would lead to an intensification of the danger of the accidental or unauthorized use of nuclear weapons.

Speaking at the press conference in Geneva after the conclusion of the Soviet-American summit meeting in November 1985, M. S. Gorbachev said: "Let us

imagine--and we said this to the American side--the consequences that even an accidental collision in space would lead to. Let us say that something separated from a rocket, the re-entry vehicle went on, so to speak, while the delivery vehicle fell off and collided with a certain group of these space weapons. Signals would flow, this could be perceived almost as an attempt by the other side...to destroy these weapons. All the computers would be turned on, while politicians could do nothing intelligent at all in this case."[19]

The danger of the unauthorized use of nuclear weapons also increases in crisis situations and in conditions of regional conflicts and of the growth of confrontation and tension in relations. In these conditions distrust intensifies, suspicion increases and one assesses the other's actions from a "worst-case" standpoint. "During a crisis--when nerves are strained, suspicion is intensified and the time for decisions is short--the chance of miscalculations that could produce a chain reaction of escalation is increased," writes American scientist (P. Bets).[20]

In such a period the accidental or unauthorized use of nuclear weapons could serve as the trigger that would produce a universal nuclear catastrophe. "A single outburst could produce such a fire that, if it got out of control, it would lead to the destruction of civilization," writes another American scientist.[21]

It should be noted that the issue of preventing the danger of the outbreak of nuclear war, including measures to avert an accidental or unauthorized use of nuclear weapons within the framework of Soviet-American talks, has its own history. As early as 1963 an accord was reached on establishing a direct communications link between the two governments for use in emergencies. In 1971 an agreement was reached on measures to improve this link so as to enhance its reliability, which noted the "positive experience accumulated in the operation of the existing direct communications link."[22] A new agreement on this score was concluded in 1984. Now entire pages of texts, photographs and graphics can be transmitted via this link.

An Agreement on Measures To Reduce the Risk of Outbreak of Nuclear War Between the USSR and the United States was signed in September 1971. In this agreement both sides recognized the "need to exert every effort to avert the risk of the outbreak of such a war, INCLUDING MEASURES TO GUARD AGAINST ACCIDENTAL OR UNAUTHORIZED USE OF NUCLEAR WEAPONS"[in boldface] (emphasis mine--M. Milshteyn). The sides already then pledged to "undertake the necessary measures aimed at averting an accidental or unauthorized use of nuclear weapons and to inform each other immediately in the event of an unauthorized, accidental or any other unexplained incident involving a possible detonation of a nuclear weapons which could create a risk of the outbreak of nuclear war" (articles 1 and 2).[23]

In May 1972 a bilateral agreement was signed on averting incidents in the open sea and in the airspace above it.[24]

An Agreement on the Prevention of Nuclear War was concluded by the USSR and the United States in June 1973. Article IV of this agreement envisages

immediate urgent consultation with each other if relations between the sides or between either side and other countries appear to involve the risk of a nuclear conflict.[25]

Unquestionably, the following should be considered among Soviet-American documents and agreements with a positive impact on reducing the risk of an outbreak of nuclear war: The Basic Principles of Mutual Relations Between the USSR and the United States, the Interim Agreement on Certain Measures with Respect to the Limitation of Strategic Arms (SALT I) and the Treaty on the Limitation of ABM Systems (all signed in 1972), the 1979 Treaty on the Limitation of Strategic Offensive Arms (SALT II) and certain others.

The Soviet-American summit meeting in Geneva in November 1985 made a major positive impact. A fundamentally important result of the meeting was that the leaders of the USSR and United States stated in a joint document: A nuclear war must not be unleashed, there can be no victors in one.

A thorough and rigorous observance of the letter and spirit of the aforesaid agreements and treaties would not only promote a decrease in the nuclear danger, and therefore a decrease in the danger of the accidental use of weapons, but would also pave the way for the conclusion of subsequent agreements aimed at further strengthening stability. However, the United States has preferred a different path.

In May 1986 the U.S. President announced his decision to refuse to observe in the future the agreements concluded by the USSR and United States regarding the limitation of strategic offensive arms. Washington, it seems, believes that the limitations imposed by these agreements hamper the unrestrained proliferation of arms and the achievement of U.S. military superiority over the USSR.

The issue of measures to prevent the accidental or unauthorized use of nuclear weapons is being widely discussed in the United States. Deliberations on this topic are held in universities, scientific research institutions and at various levels in the government and in Congress. Even Defense Secretary C. Weinberger in 1983 presented a report to Congress on "Direct Communication Links and Other Measures To Strengthen Stability," which assessed the "potential advantages and shortcomings of possible new initiatives aimed at reducing the danger of the accidental use (or use due to a miscalculation) of nuclear weapons."[26]

According to American scientists, the creation of special parallel or joint centers for this purpose is considered to be the most effective measure to prevent the nuclear danger, including the accidental use of nuclear weapons.

In September 1982 the American Arms Control and Disarmament Agency instructed Harvard University to develop ideas regarding measures to prevent crisis situations. In March 1984 these ideas were put forward. A proposal was advanced on the expediency of creating a special center aimed at not allowing crisis situations to develop into a nuclear conflict.[27]

On the initiative of Senators S. Nunn and J. Warner, a working group was organized in 1982 to develop measures to reduce the risk of nuclear war. The group included, in addition to the aforementioned senators, many prominent political and public figures and scientists. In November 1983 the group published a report whose main point was a recommendation to create "centers to prevent nuclear war." It was proposed as a first step that the Soviet Union and the United States simultaneously create special national centers to prevent nuclear war, which could be provided with appropriate communications facilities and outlets to the countries' leaders and invested with broad powers. It was also proposed to create joint centers.[28]

The idea of joint centers is being developed by many American specialists. In a work on this topic that appeared in 1986 under the aegis of the Center for Strategic and International Studies of Georgetown University, B. Blechman and M. Krepon proposed to entrust the joint centers with round-the-clock duty and observation of events that could lead to the accidental use of nuclear weapons. Besides duty, it is proposed that they take on the task of exchanging information and of assessing a situation with the aim of preventing "nuclear crises."[29]

The Center for Security and Control Problems of Stanford University has also done its bit in developing the idea of creating such a Soviet-American center: At the beginning and in the middle of 1983 it held special scientific conferences on this topic with the involvement of well-known scientists, experts and specialists. The main result was a proposal on the creation of a "joint center to reduce the risk of the accidental outbreak of nuclear war."[30]

The joint Soviet-American statement adopted in Geneva in November 1985 says the following about the centers: "The sides agree to study, at the level of experts, the issue of centers to reduce the nuclear danger, taking into consideration the development of the Geneva talks and the issues being discussed there."[31] On 5-6 May and 25 August 1986, preliminary Soviet-American consultations were held in Geneva to study the issue of centers.

As is clear from the aforesaid Soviet-American joint statement, the issue of centers must be viewed in direct association with the development of the talks on nuclear and space arms. But the American side is still taking an obstructionist position in these talks. Also, this issue cannot be separated from a concrete policy that is being carried out by the sides in the area of displaying restraint in the military-political sphere. Meanwhile, it is known that the United States responds to the numerous and far-reaching peace initiatives of the Soviet Union by intensifying the arms race and by plans to extend it to outer space.

The most effective way of preventing the accidental or unauthorized use of nuclear weapons would be their removal from national arsenals. If mutually acceptable agreements are not reached at the Geneva talks on nuclear and space arms, and if a normalization of political relations and an improvement of the international climate do not take place, no special center will reduce the nuclear danger and the risk of the accidental use of nuclear weapons.

The moratorium on nuclear tests announced by the Soviet Union and the decision to extend it to 1 January 1987 bear a direct relationship to measures to prevent the accidental outbreak of nuclear war. The point is that the issue of a moratorium must be viewed not in isolation, but in the context of the general problem of ridding mankind of nuclear weapons. If the United States joins the Soviet Union, this would be a major step toward ending the refinement and stockpiling of nuclear weapons, and therefore toward the prevention of the accidental outbreak of war.

The prevention of a nuclear danger, including the accidental and unauthorized use of nuclear weapons, is not only and not so much a technical matter as a political one. Its resolution requires a display of genuinely historic responsibility from the political leadership. "You raise the issue of reducing the risk of nuclear war and of the need for active measures," M. S. Gorbachev said in a talk with representatives of an international forum of scientists for the termination of nuclear tests. "The Soviet leadership supports this appeal."[32]

Unfortunately, for the time being one does not see this from Washington.

FOOTNOTES

1. THE TIMES, 22 June 1986.

2. "Nuclear Weapons Databook. Vol I: U.S. Nuclear Forces and Capabilities," Cambridge, 1984, p 113.

3. D. Krieger, "Preventing Accidental Nuclear War," Santa Barbara, 1984, p 4.

4. D. Ford, "The Button. The Pentagon's Strategic Command and Control System," N.Y., 1985, p 24 (see SSHA: EPI, 1986, No 3, pp 98-104--Ed.).

5. D. Ford, Op. cit., pp 16, 18.

6. Ibid., pp 64, 85; R. Bracken, "The Command and Control of Nuclear Forces," New Haven, 1983, pp 15, 36.

7. D. Ford, Op. cit., pp 6, 15, 16, 29, 30, 34, 60; "The Nuclear Time Bomb," PEACE RESEARCH REVIEWS, May 1986, p 34; R. Bracken, Op. cit., pp 22-23, 25, 26.

8. "The Nuclear Time Bomb," pp 93-94.

9. D. Ford, Op. cit., p 86.

10. Ibid., p 17.

11. "Nuclear War by Mistake--Inevitable or Preventable? Report from an International Conference in Stockholm, 15-16 February 1985," p 4.

12. "The Nuclear Time Bomb," p 109.

13. R. Bracken, Op. cit., pp 48-49.

14. Ibid., pp 54-55; D. Ford, Op. cit., pp 78-79.

15. D. Ford, Op. cit., p 22.

16. THE BULLETIN OF THE ATOMIC SCIENTISTS, November 1980, pp 16, 20.

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CSO: 1803/02

SURVEY OF SOVIET-AMERICAN CULTURAL, SCIENTIFIC TIES

Moscow SSHA: EKONOMIKA, POLITIKA, IDEOLOGIYA in Russian No 10, Oct 86 (signed to press 15 Sep 86) pp 14-24

[Article by A. V. Andreyev]

[Text] The exchange of cultural values and scientific contacts are important and effective means of achieving international detente and establishing relations of trust, mutual understanding and cooperation between states. Differences in social and political systems and the struggle of ideologies are not at all inconsistent with this kind of cooperation.

From the time of its founding, the Soviet state has consistently tried to establish mutually beneficial relations, including cultural and scientific ties, with all countries. The policy line of our party and government stems directly from the Leninist premise that "Marxism has not discarded the most valuable achievements of the bourgeois era, but, rather, has assimilated and digested everything of value in the more than 2,000 years of the development of human thought and culture."[1] The Political Report of the CPSU Central Committee to the 27th Party Congress listed the "reinforcement and search for new forms of cooperation in the areas of culture, the arts, science, education and medicine" among the fundamental bases of the comprehensive system of international security in the humanitarian sphere.[2]

The Soviet Union's attitude toward the development of cultural and scientific ties with foreign countries has never depended on circumstances. It is based on the fundamental policy line of mutually beneficial cooperation among states with different social systems. Furthermore, the Soviet Union believes that it serves the cause of peace and brings people closer together. The USSR bases its cultural and scientific ties with foreign countries on the principles of equality, mutual respect, the strict observance of national sovereignty and non-intervention in internal affairs, with a view to the laws and constitutional requirements of each country.

By 30 December 1917 the Soviet Government had already published an appeal to the people and governments of allied countries, stating that "the program of the republic of Soviets is intended to create the kind of conditions in which... all people can be united in economic and cultural cooperation."[3]

As the young Soviet republic matured and grew stronger, feelings in favor of the development of relations with the USSR in various fields of culture and science grew stronger in the Western countries, including the United States. In 1921 the board of directors of the U.S. National Academy of Sciences formed a provisional committee to draw up a plan for bilateral contacts by American scientists with representatives of the scientific community of Soviet Russia. The Society of Friends of Russia and the American-Russian Institute (in the United States) and the All-Union Society for Cultural Contacts with Foreign Countries, founded in the USSR in 1925, were instrumental in the development of USSR-U.S. contacts, including cooperation in science and culture. In 1927 the USSR took part in an international exhibit of contemporary architecture in the United States. The USSR's participation in the New York World's Fair of 1939 did much to familiarize Americans with the Soviet Union's cultural and scientific achievements. The cultural and scientific contacts between the USSR and the United States in the pre-war years, however, were mainly of a sporadic nature.

The historic victory of the Allied powers over fascism and the USSR-U.S. alliance in the war years created favorable conditions for the development of cultural and scientific cooperation. These opportunities, however, remained unutilized when the United States adopted the policy of "cold war" soon afterward, a policy which impeded the development of Soviet-American ties for many years. Nevertheless, the champions of "cold war" were incapable of erecting insurmountable obstacles to inhibit the desire of the people of both countries for better bilateral relations.

The first steps toward the establishment of Soviet-American cultural cooperation after the war were taken in 1955: The American "Everyman Opera" company toured the USSR, and renowned Soviet performers D. Oistrakh and E. Gilels made extremely successful appearances in the United States. That same year an agreement was reached on the circulation of magazines on a mutual basis--SOVIET LIFE in the United States and AMERICA in the USSR.

The Soviet launch of the world's first artificial satellite in 1957 made a tremendous impression on the Americans. This remarkable event was extensively covered in the American press as an outstanding achievement of Soviet science; it offered conclusive proof that the Soviet Union had taken a leading position in world science and was an equal partner in international exchanges.

An agreement on exchanges in science, technology, education, culture and other areas was signed by the USSR and the United States in Washington on 27 January 1958, laying a legal foundation for the development of cultural and scientific ties for the first time in the relations between the two countries. The agreement also had the political aim of improving Soviet-American relations in general and played a definite role in the relaxation of international tension. It provided an opportunity for the planning and organization of extensive cultural and scientific exchange.

The cultural and scientific cooperation of the USSR and United States in subsequent years was stable until 1979. During this period dozens of Soviet groups performed in the United States, groups representing the pride of our

performing arts--the ballet and opera companies of the Bolshoi Theatre and the Leningrad Opera and Ballet Theatre imeni S. M. Kirov, the State Academic Folk Dance Company of the USSR under the direction of I. Moiseyev, the Berezka Choreographic Company, the dance companies of the Ukraine and Georgia, the best symphony orchestras of the Soviet Union, the Moscow State Philharmonic Chamber Music Orchestra, the Moscow Academy of Arts Theatre, the State Central Puppet Theatre under the direction of S. Obraztsov, circuses and many other groups. The Soviet soloists performing in the United States included such famous names as D. Oistrakh, E. Gilels, S. Richter, L. Kogan, G. Ulanova, M. Plisetskaya, R. Struchkova and Ye. Obraztsova.

The American groups touring the USSR included the Boston, New York, Philadelphia and Cleveland symphony orchestras, the New York Ballet under the direction of G. Balanchine, the Jose Limon Ballet Company, the Joffrey Ballet, several student musical groups, Washington's Arena Stage Theatre, the jazz bands of Duke Ellington and Benny Goodman and others. Soviet audiences attended the concerts of the outstanding American composers L. Stokowski and E. Ormandy and heard the voices of Paul Robeson and L. Warren.

In 1958 American pianist Van Cliburn was awarded a gold medal as the winner of the First International Tchaikovsky Competition in Moscow. This event had broad repercussions in both countries. In his own country Van Cliburn was honored as a national hero.

A Soviet exhibit in New York and an American exhibit in Moscow were held in 1959 in accordance with the agreement on the mutual exchange of exhibits in the spheres of science, technology and culture. This was followed by the exchange of other traveling exhibits. A Soviet exhibit of "The Folk Art of the Republics of the USSR" was held in the United States in 1972. Other expositions of major importance were also organized, such as "Soviet Museum Treasures," "Masterpieces of Art from the Hermitage and the Russian Museum," "Scythian Art Treasures," "The History of Russian National Costume," "Russian and Soviet Painting from the 15th Century to Our Day," "Russian Art from 1800 to 1850" and "Moscow Kremlin Museum Treasures."

American museums contributed works of art for exhibits in the USSR--"Masterpieces of Italian Art from American Museum Collections," "Classical Art from the Metropolitan Museum Collection," "Pre-Columbian Gold," "American Realist Painters of the Second Half of the 19th Century and the 20th Century" and others.

The famous American impresario Sol Hurok and Doctor Armand Hammer, the president and chairman of the board of Occidental Petroleum, did much to publicize Russian and Soviet culture in the United States and to familiarize Soviet people with the masterpieces of world art.

Soviet-American contacts in the theatre were expanded. An exchange of outstanding directors for discussions on art was organized. The exchange of directors for the staging of plays in the theatres of the other country was a new form of cooperation. For example, Soviet directors G. Volchek, A. Efros and O. Yefremov staged successful productions of "Echelon," "The Marriage," "Moliere" and "Valentine and Valentina" in American theatres.

Cooperation in television broadcasting began to be developed at the end of the 1960's. Several programs on science, agriculture, culture and space research in the USSR were made for the American viewing audience at the request of various American TV broadcasting companies. The cooperation became much more active in the early 1970's, when the State Committee of the USSR for Television and Radio Broadcasting signed long-term agreements with three U.S. broadcasting companies: NBC, CBS and ABC. During this period the sides exchanged delegations of television personalities and completed several major projects. In 1975, for example, the ABC company made a 10-hour program on Moscow for the "Good Morning America" show. The same company headed the TV network coverage of the "Soyuz-Apollo" space flight and videotaped several international sports competitions in the USSR.

Between 1980 and 1985, 1,784 books by American authors were published in the Soviet Union--203 million copies in all. The most popular American writers are J. London, M. Twain, T. Dreiser, J. Reed, E. Hemingway, O. Henry, W. Faulkner, E. Caldwell, S. Lewis, H. Longfellow and W. Whitman. During these years the works of Hemingway alone were published 70 times in our country in over 11 million copies. Along with the classics of American literature, contemporary American writers are widely published in the USSR: I. Asimov, K. Vonnegut, I. Stone, J. Updike and others. In 1978 the centennial of Upton Sinclair's birth was celebrated in the Soviet Union. The work on a 45-volume "Library of U.S. Literature" is now being completed in the Soviet Union.

American editions of the Russian classics are extremely rare, however, and the Americans know almost nothing about contemporary Soviet literature.

Exchanges in higher education began in 1958. An American intercollegiate committee headed by Professor R. Burns from the University of Indiana was the first partner of the USSR Minvuz [Ministry of Higher and Secondary Specialized Education] for 10 years. These functions were transferred to the new International Research and Exchange Council (IREX) on 1 July 1969. The Council for the International Exchange of Scholars and the International Relations Agency also became involved in this form of cooperation in the United States later. Participants in the exchanges were young scholars working in higher academic institutions, qualified specialists participating in research projects, scholars presenting lectures, instructors in linguistics working on the improvement of language teaching methods and delegations studying the problems of higher education. Direct cooperation between universities in the two countries occupied a special place in the exchanges. In one project, Russian language textbooks for American colleges and universities were compiled jointly with American authors.

The improvement of the international situation in the early 1970's led to the further expansion of Soviet-American cultural and scientific contacts. Soviet-American agreements on cooperation in medicine and public health, in environmental protection, in science and technology and in the study and use of outer space for peaceful purposes were signed in Moscow in May 1972. Finally, the desire of both sides for the further expansion of cultural and scientific contacts was recorded in a document as important as the Basic Principles of U.S.-Soviet Relations.

A general Soviet-U.S. agreement on contacts, exchanges and cooperation during the period up to 31 December 1979 was concluded in Washington on 19 June 1973. Programs of cultural, scientific and educational exchanges for 1974-1976 and 1977-1979 were later drawn up in accordance with this agreement. This created additional favorable conditions for cultural and scientific relations, which took more diverse forms and acquired more meaningful content. They represented an important factor and visible proof of the burgeoning process of international detente.

Important additional momentum for the improvement of the international climate in general and for the development of Soviet-U.S. cultural and scientific cooperation was provided when the Conference on Security and Cooperation in Europe reached its successful conclusion in August 1975 and when the basic principles and guidelines of intergovernmental cooperation were negotiated and legally secured. The Final Act of the conference specifically states that "cultural exchanges and cooperation promote better mutual understanding between people and between nations and thereby promote stronger accord between states."[4]

The agreement on scientific exchanges and cooperation between the USSR Academy of Sciences and the U.S. National Academy of Sciences in 1979 and 1980 was signed in February 1979 and was later renewed. In reference to the American side's interest in the development of cooperation, IREX Executive Director A. Kassof said: "For hundreds of American scholars studying the Russian and Soviet culture and way of life, these exchanges are of tremendous value as opportunities for consultation and cooperation with Soviet colleagues, opportunities for direct contact with the spiritual life of the country they are studying."[5]

The international situation was severely complicated at the turn of the decade. The imperialist powers, especially the United States, openly chose to return to the policy and methods of "cold war." The Sovietophobia which had died down in the years of detente was revived in an even more dangerous form. This soon affected the status of cultural contacts between the two countries.

Appearances by Soviet performers in the United States took place under difficult conditions. They had to deal with hostile demonstrations, acts of vandalism and even direct harrassment during performances, often with the connivance of the authorities.

The reaction of American officials to these actions, which were contrary to the elementary standards of intergovernmental relations, was the demagogic statement that the U.S. Government could not influence the "political behavior of its citizens."

For this reason, when the general agreement expired and its renewal began to be negotiated in Moscow at the end of 1979, the Soviet side asked that the text of the agreement stipulate the obligation of the U.S. federal government to guarantee the safety and normal working conditions of Soviet participants in exchanges. The American delegation objected to this and broke off the talks.

In a televised speech on 4 January 1980, President J. Carter announced the curtailment of economic, scientific and technical contacts and cultural exchanges with the Soviet Union. This was followed by Deputy Secretary of State W. Christopher's announcement that the American side did not plan to resume the talks for the negotiation of a new agreement on exchanges and contacts. The State Department then announced the government's decision not to hold the already planned exhibit of works from the State Hermitage collection in the United States, alleging that this was not in the "national interest of the United States."

The Reagan Administration took the same position and went even further by announcing a "crusade" against the Soviet Union. Flagrantly violating the universally accepted rules and standards of intergovernmental relations, the American administration launched an unbridled anti-Soviet propaganda campaign. The supporters of the "hard line" want the sphere of U.S.-Soviet cultural and ideological relations to be regarded as a major element of foreign policy strategy. It is easy to see that the outbursts of anticommunist campaigns, especially in the sphere of culture, coincide with successive rounds of the American arms race.

It must be said that the U.S. administration's obstructionist position has deprived the people of both countries of a chance to learn more about one another's culture and art.

In spite of Washington's official policy line and the intense propaganda, however, sensible forces in the United States have always advocated the continuation of contacts with the Soviet Union and the development of mutually beneficial relations in culture and science. Broad segments of the American public have expressed an interest in acquiring accurate information about our country and its culture, science, education, motion pictures and sports.

Adhering to the Leninist line of peaceful coexistence with capitalist countries, the Soviet Union has consistently favored the normalization of relations with the United States. While the United States has persistently tried to stop the development of bilateral cultural and scientific cooperation, the Soviet Union has consistently pursued the further development of contacts. Our country believes that these contacts enrich national cultures, develop and extend the worldwide legacy of mankind in this sphere and represent an important element of stronger friendship and mutual understanding between nations and a serious factor in the defense of peace.

The absence of an agreement and the general deterioration of Soviet-U.S. relations through Washington's fault affected the development of cultural contacts, which have been of a limited nature in recent years.

Some cultural contacts were organized through public organizations. For example, small groups of performers and soloists were sent to the United States, and representatives of the American culture and arts were invited to the USSR, by the Rodina Society and the Union of Soviet Societies for Friendship and Cultural Relations with Foreign Countries (SSOD). (A program of cooperation by the SSOD, the USSR-U.S. Society and the National

American-Soviet Friendship Council for 1981-1983 was signed in December 1980 and was later renewed every 2 years.)

Appearances by performers on both sides were sporadic and were organized outside government channels. A concert by Soviet pianist E. Gilels was organized by the board of directors of Carnegie Hall in New York in April 1983. Again, hostile elements formed picket lines in front of the building and tried to frighten the board of directors with bomb threats. In July 1983 New York State Senator M. Markowitz had to give up his plans to organize a concert by Soviet singer S. Rotaru in New York when he heard that Zionist organizations intended to disrupt the concert.

In 1984 the UN secretary-general invited Soviet violinist V. Tretyakov to perform in New York, where he was accompanied by the Pittsburgh Symphony Orchestra in the UN building and then at Carnegie Hall. That same year American singer J. Conwell took part in a Bolshoi Theatre tribute to Mario del Monaco, and popular singer and songwriter John Denver made successful appearances in Moscow and Leningrad.

When the American authorities refused to guarantee the safety of exhibits, the Soviet side was unable to lend paintings from Soviet collections to the National Gallery of Art in Washington, the Metropolitan Museum, the Museum of Modern Art and the Cleveland Art Museum. Extremely limited exchange in this area was made possible only by the initiative of private companies and public organizations. In July 1982 the USSR Union of Artists organized an exhibit of the works of American elder painter E. Neill in Moscow. In 1984 an exhibit "The Code of Leonardo da Vinci" was held in Moscow and Leningrad with the assistance of A. Hammer.

Limited cooperation in the dramatic arts also continued. B. Vasilyev's "Dawn Is Quiet Here," A. Galin's "Retro" and several other plays were staged in the United States and received good reviews in the American press. It must be said, however, that the American audience knows little about Soviet drama, while plays by more than 30 American authors can now be seen in 105 theatres in the Soviet Union. American leaders in this field were invited to the USSR for conferences on the arts.

Cooperation in television began to decline in the beginning of 1980. Several of the companies with which a good working relationship had previously been maintained (NBC Sports, Trans-World International and Cates Brothers) announced that they could not fulfill certain obligations. The sale of Soviet TV programs, however, continued through Armand Hammer Productions, Metromedia, Brian Jackson Films and a middleman firm, Foreign Transactions.

A fundamentally new form of cooperation came into being at that time--the so-called spacebridges, establishing direct bilateral contact between large groups of participants in the USSR and United States and organized jointly by public organizations in both countries. The topics of discussion are the most vital issues of the present day. Programs have dealt with "The World After Nuclear War" (the Moscow-Washington spacebridge), "The World Without Wars" (Moscow-San Francisco), "Memories of the War" (Moscow-San Diego), "In Memory

of Samantha Smith (Moscow-Minnesota) and "Citizens' Summit Dialogue" (Leningrad-Seattle).

Exchanges in higher education have been reduced substantially in recent years. Washington has used the excuse of "technological information leaks" to limit exchanges of scholars and lecturers. The American side has made every effort to keep Soviet specialists and scholars in the natural sciences out of the United States.

There are still limited intercollegiate contacts between the State University of New York on one side and Moscow State University and the First Moscow State Pedagogical Institute of Foreign Languages imeni M. Thorez on the other, as well as between Moscow State University and the University of Missouri and the California Institute of Technology.

The anti-Soviet campaign launched in 1983-1984 and the absence of security guarantees for Soviet scholars in the United States forced the USSR Minvuz to recall its exchange scholars in September 1983 and to suspend all exchanges until February 1984. Nevertheless, the interest in the Russian language and literature promoted the establishment of cooperation between the Moscow Russian Language Institute imeni A. S. Pushkin and the Modern Language Association. More Americans are studying the Russian language in their own country and traveling to the USSR to improve their language skills. In turn, the Soviet Union is sending specialists in the English language to the United States.

In the sphere of motion pictures the Soviet Union is still participating in traditional international film festivals and in the organization of the screening of Soviet films in the United States. In 1981 the Soviet movie "Moscow Does Not Believe in Tears" was awarded the Oscar for the best foreign film by the American Academy of Motion Picture Arts and Sciences. The American motion picture industry takes part in the international film festivals in Moscow and sends its representatives to the international film festival in Tashkent.

Exchanges in book publishing and the publication of periodical literature have also suffered through the fault of the American side. It is true that books, newspapers, magazines, phonograph records and postage stamps for collectors have been sent to the United States by the Mezhdunarodnaya Kniga Association, and that the literature of Plenum Publishing was displayed at the book fair in the Moscow House of Books in 1981. In 1984 the Soviet side took part in Art Expo, an international art fair in Chicago. The next year, however, the organizational committee of this fair used "political reasons" as an excuse to keep a Soviet organization from participating in another such undertaking.

The contacts between the All-Union Copyright Agency (VAAP) and its partners in the United States were reduced substantially at the beginning of the 1980's, and also through the fault of the American side. Many contracts were broken or shelved. In spite of this, American publishers and cultural figures have recently displayed greater interest in more active and extensive cooperation with the VAAP. Business relations are being established with the American

Society of Composers, Authors and Publishers, the Association of Artist-Run Galleries, the Copyright Office and the Harry Fox Literary Agency.

Cooperation by writers occupies a prominent place in cultural exchange. The latest meeting of Soviet and American writers was held in Vilnius in November 1985. The main topics of discussion in addition to problems of a literary nature were the need to keep and consolidate the peace and the struggle against the arms race. A joint appeal to General Secretary of the CPSU Central Committee M. S. Gorbachev and President R. Reagan of the United States was adopted at the meeting and said that the establishment of a healthy climate in relations between our countries is in the public interest. The voices of those demanding the elimination of the threat to life in today's world are heartily supported by writers.[6]

The traditional contacts between athletes in the two countries were injured when the anti-Soviet hysteria was stirred up in the United States and the Olympics in Moscow were boycotted. The further escalation of hostility toward the USSR just before the Olympics in Los Angeles made participation by our athletes in these games impossible. This led to the substantial reduction of bilateral contacts in sports. The U.S. trips scheduled for that time for gymnastics, tennis, cycling and basketball teams had to be canceled.

The Soviet athletic community has invariably tried to contribute to the normalization of Soviet-American relations and the reinforcement of mutual understanding. In 1983 a Soviet delegation of track and field athletes took part in a competition organized by the American Athletes for Peace in Lawrence, Kansas. The Soviet delegation's stay in Lawrence received extensive media coverage. The period of competition from 18 to 25 April was declared a "week of Soviet-American mutual understanding" by the mayor of the city. A joint appeal for peace by Soviet and American athletes was published at the end of the competition.

The deterioration of bilateral relations has also affected Soviet-American scientific contacts in recent years. Intergovernmental exchanges of scientists, joint research and other forms of scientific exchange have been reduced: Through the fault of the American side they are at a level far below the interests and capabilities of our countries with their tremendous scientific and technical potential. Several Soviet-U.S. intergovernmental agreements expired in 1982. It was within the framework of these that the USSR Academy of Sciences conducted joint research and scientist exchanges (in the spheres of science and technology, power engineering, space research and so forth). The American side declined to renew them and imposed additional restrictions on entry visas for Soviet scientists.

Nevertheless, the bilateral contacts between the scientists of the USSR Academy of Sciences and U.S. National Academy of Sciences regarding international security and arms limitation continued. The Committee of Soviet Scientists for Peace and Against the Nuclear Threat, headed by Academician Ye. P. Velikhov, vice president of the USSR Academy of Sciences, has done a great deal in this field. Soviet and American scientists met in Washington in spring 1986 to discuss the prevention of the militarization of space, nuclear arms reduction and limitation and other issues.

Many American scientists interested in scientific cooperation with the Soviet Union have not been swayed by the anti-Soviet campaign in the United States and have advocated the renewal of existing agreements. After a long interval, an agreement on cooperation between the USSR Academy of Sciences and the U.S. National Academy of Sciences was signed in April 1986.

Past experience has demonstrated the importance of scientific cooperation for the future of the human race in today's world. This was vividly reaffirmed after the accident at the Chernobyl nuclear power plant. While official Washington took advantage of this disaster for shameless speculation and unscrupulous attempts to fuel distrust of the Soviet Union, sensible people in the United States sympathized with the victims of these events. In the assistance of these victims by American physicians R. Gale and P. Tarasaki and prominent businessman and public spokesman A. Hammer, "the Soviet people," as M. S. Gorbachev said, "see an example of how relations between two great nations should be constructed in the presence of political wisdom and will on the part of the leaders of both countries."[7]

In July 1986 a group of physicists from the United States assisted in the installation of American seismic equipment near Semipalatinsk in the USSR. This was made possible by an agreement between the USSR Academy of Sciences and the U.S. Natural Resource Defense Council, signed on 28 May with the aim of proving that the mutual detection of nuclear explosions is possible and, consequently, that a nuclear test ban would be completely verifiable.

Professor T. Cochran, an American geophysicist, reported the success of the first experiment of this program in Moscow at an international forum of scientists for the cessation of nuclear tests.

In general, the history of bilateral relations testifies that even the anti-Soviet policy line of U.S. ruling circles cannot put an end to mutually beneficial cultural and scientific ties with the Soviet Union. The Soviet leadership has always favored the improvement of Soviet-American relations and the elimination of the dangerous escalation of international tension.

The summit meeting of the Soviet and U.S. leaders in Geneva in November 1985 was an important milestone in Soviet-American relations in recent years. It filled the minds and hearts of millions of people in the world with the hope of a healthier international climate and lasting peace. The categorical announcement that nuclear war must never be started was made at the meeting. Constructive labor, the development of the spiritual life of society and normal relations between countries are possible only in times of peace.

There was a productive exchange of opinions and new ideas on bilateral relations at the Geneva meeting. The two sides agreed to contribute joint research and actions to the global cause of environmental protection. They agreed to hold consultations in Moscow and Washington in 1986 in accordance with the existing Soviet-American agreement in this area. A general agreement on intergovernmental contacts, exchanges and cooperation in science, technology, education, culture and other areas for the next 6 years and a program of cooperation and exchanges for 1986-1988 were signed. The general agreement

lists the principles on which Soviet-U.S. cultural and scientific ties will be based, reaffirms the corresponding provisions of the Basic Principles of U.S.-Soviet Relations of 1972 and the Helsinki Final Act and, what is most important, expresses the desire of the two sides for stronger mutual understanding.

In a joint statement the two leaders agreed on the need for broader exchanges and contacts, including some new forms in several fields of science, education, medicine and sports.

The results of the November summit meeting led to talk about the beneficial "spirit of Geneva."

After the meeting, steps were taken to implement these agreements. A touring company from the Children's Theatre of Albany (New York), under the direction of P. Sneider, arrived in Moscow in the first days of the new year of 1986. Conductor Yu. Temirkanov and pianist N. Petrov went to the United States to perform with the New York Symphony. Famous American pianist V. Horowitz performed in the USSR. "Masterpieces of French Painting" from the collections of the National Gallery of Art in Washington and Armand Hammer were exhibited in Leningrad and Moscow. "Five Centuries of Masterpieces" from the collection of this famous American collector were exhibited in Moscow, Leningrad, Kiev and Novosibirsk. The Goodwill Games, in which Soviet and American athletes participated, were held successfully in Moscow from 5 to 20 July.

At a press conference held in Moscow on 3 January to discuss Soviet-American cultural exchanges in light of the Geneva summit meeting, representatives of the USSR Ministry of Culture and renowned Soviet masters of literature and the arts discussed their plans for cooperation with American partners and expressed the conviction that cultural exchanges should be developed productively in the interests of the people of both countries.

Soviet-American consultations on the general agreement and the program of cooperation and exchanges were held in Washington at the beginning of August 1986. The two sides noted that exchanges in these areas had been more active since the Geneva meeting. They signed several working documents specifically envisaging the exchange of exhibits of paintings from Soviet and American museums, the expansion of teacher and student exchange programs, cooperation in Russian and English language instruction and the development of programs of microcomputer-aided instruction in secondary schools. The activities of the Soviet-American Joint Commission on Cooperation in Public Health were resumed after an interval of many years and plans were made for the resumption of cooperation in the fight against cancer.

It appears, however, that this prospect does not please all Americans. The same rightwing forces that tried to exclude the very possibility of the Geneva meeting are now opposing the relaxation of tension in relations with the USSR and are striving to use cultural media to sow hatred between the people of the two countries.

The United States has been literally inundated with an anti-Soviet wave in the mass media. The press is fueling the anti-Soviet campaign and encouraging

spy-mania. Soviet participants in exchange programs have been the target of physical threats, demonstrations and picket lines. Shopworn anti-Soviet goods are flooding the movie and television market. Such misanthropic films as "Red Dawn," "Rambo" and "Rocky IV," in which the Soviet Union is portrayed as the "enemy of freedom and democracy," are playing in American movie theaters. The ABC company is preparing a 14-part miniseries, "Amerika," about the horrors of a hypothetical "10-year occupation of the United States by Soviet troops."

It appears that some people are deliberately trying to plant a completely distorted image of the Soviet individual in American minds and to undermine the budding hopes for detente and trust that were so carefully engendered at the Geneva meeting. These attempts, which the Washington administration is encouraging instead of discouraging, are in complete conflict with the "spirit of Geneva," with the letter of the intergovernmental general agreement signed there and with the joint statement in which the two sides unequivocally advocate "stronger mutual understanding."

The Soviet Union, on the other hand, is taking every opportunity to use cultural media for the reinforcement of the positive results of the Geneva meeting. M. S. Gorbachev made the following reference to Soviet-American relations in the political report to the 27th CPSU Congress: "We attach great importance to the status and nature of the Soviet Union's relations with the United States. Our countries have many points in common, and there is the objective need to live together on earth and to work together on an equal and mutually beneficial basis--and only on an equal and mutually beneficial basis."[8]

The USSR and the United States bear a special responsibility for the political climate on our planet and for the preservation of human civilization and world culture. Mutual understanding and productive cooperation between the two countries are especially necessary today.

FOOTNOTES

1. V. I. Lenin, "Poln. sobr. soch." [Complete Collected Works], vol 41, p 337.

2. "Materialy XXVII syezda Kommunisticheskoy partii Sovetskogo Soyuza" [Materials of the 27th CPSU Congress], Moscow, 1986, p 76.

3. "Dokumenty vneshney politiki SSSR" [Foreign Policy Documents of the USSR], vol I, Moscow, 1959, p 68.

4. "The Final Act of the Conference on Security and Cooperation in Europe, Helsinki, 30 July--1 August 1975," Moscow, 1985, p 61.

5. THE ANNALS OF THE AMERICAN ACADEMY OF POLITICAL AND SOCIAL SCIENCE, July 1974, pp 74-75.

6. LITERATURNAYA GAZETA, 20 November 1985.

7. PRAVDA, 16 May 1986.

8. "Materialy XXVII syezda Kommunisticheskoy partii Sovetskogo Soyuza," p 64.

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THE ROLE OF THE DOLLAR IN U.S. FOREIGN TRADE

Moscow SSHA: EKONOMIKA, POLITIKA, IDEOLOGIYA in Russian No 10, Oct 86 (signed to press 15 Sep 85) pp 25-35

[Article by M. V. Yershov: "Currency Rates and Foreign Trade"]

[Text] The rise in the exchange rate of the dollar in the first half of the 1980's sharply reduced the competitive potential of American goods, led to the further growth of the deficit in the U.S. balance of trade, aggravated the indebtedness of the developing countries and had a perceptible effect on the state of the entire world economy. These events called for a closer look at current processes in the sphere of international payments and at the natural laws governing world trade and monetary relations.

As a result of the expansion of international division of labor, foreign trade and currency operations are acquiring increasing dimensions and having an increasing effect on the conditions of reproduction in various countries. "Capitalist production rests on value, or on the development of the labor invested in the product into social labor," K. Marx wrote. "But this is (possible) only on the basis of foreign trade and the world market. Therefore, foreign trade and the world market are both the prerequisites and the results of capitalist production."[1]

International currency operations outgrew the function of serving foreign trade long ago. Payments with no connection with trade are having an increasing effect on currency exchange rates, and these, in turn, are perceptibly changing the export and import parameters of various countries. Under present conditions, now that the constant growth of foreign trade volumes is accompanied by more dramatic fluctuations in currency exchange rates, it is much more important to take the currency factor into account in international economic exchange.

What factors influence currency exchange rates, to what degree do they influence them, and how are rate fluctuations reflected in the foreign trade of a country? How important is the currency factor in international payments? This obviously depends on how widely each specific currency is used in international transactions. The American dollar, the main currency of international transactions, is naturally of paramount importance in the analysis of these matters. The author of this article will attempt to assess the place and

role of the dollar in the system of international accounts, to point out the factors with a decisive effect on exchange rates and to show how rate changes affect U.S. foreign trade.

Factors Affecting Exchange Rates

The introduction of the system of "floating" exchange rates broadened the range of their fluctuation, heightened the instability of the currency sphere and complicated the regulation of rates. Figure 1 indicates that even an indicator as relatively stable as the effective exchange rate index, which is calculated in relation to the group of main capitalist currencies, changed considerably in the 1980's. The number of factors affecting the exchange rate increased. Although it can still be defined as the "price" of the monetary unit of a country in the monetary unit of another country,[2] the set of elements influencing the rate and the nature of their interaction are changing.

Currency exchange rates have traditionally been regarded as indirect assessments of national worth through the comparison of national monetary units.[3] It is true that national worth has always been one of the elements affecting exchange rates. Other factors traditionally occupying an important place in this process have not lost their role either. On the contrary, some of them, particularly interest rates, now have an even stronger influence. Even K. Marx referred to this: "The rate of exchange is influenced by the interest rate, namely the correlation of the interest rates of the two countries involved in the exchange."[4] It is understandable that a relatively high interest rate will create favorable investment conditions in a country and attract capital to it. The result is a rise in the demand for the currency of this state and a rise in its exchange rate. In reference to the situation of the early 1980's, the FINANCIAL TIMES stressed that "colossal capital movements...are making currency exchange rates increasingly dependent on interest rates."[5] The calculation of relative interest rates can heighten the accuracy of exchange rate forecasts.[6]

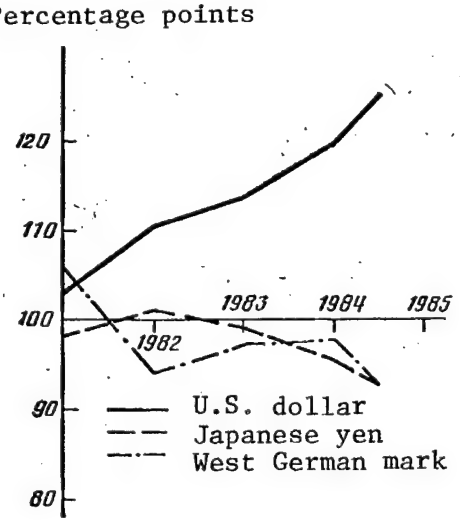

Figure 1. Index of effective exchange rates of some currencies. (ECONOMIC AND FINANCIAL PROSPECTS, Swiss Bank Corp., October/November 1985.)

The balance of payments (and trade), connecting exchange rates and interest rates with capital movements, is still important. This connection is all the more apparent when the trade balance and interest rates are viewed as factors influencing the rate of exchange. An attempt at the numerical description of their interaction with an equation based on data for 1970-1985 led to the following results:

$$ER=5.751+2.70TB+286.71 \qquad R^2=0.521$$
$$(2.3)\ (3.1)\ \ (20.7) \qquad DW=1.23,$$

where ER signifies the average annual yen/dollar exchange rate;
I signifies the difference between U.S. and Japanese interest rates, 3-year lag (money market rates for end of period);
TB signifies the balance of U.S. trade with Japan, 2-year lag (in billions of dollars).

The T-statistics cited under the corresponding coefficients testify that both parameters--trade balance and difference between interest rates--are significant--that is, they both do have a considerable effect on exchange rates. In particular, a unit of increase in the difference between interest rates will raise the yen/dollar exchange rate by 5.75 units, which actually signifies the revaluation of the dollar. By the same token, a unit of increase in the U.S. balance of trade with Japan will raise the exchange rate by 2.7 units, and in both cases the influence is not immediate but involves a lag of some duration.

The relatively low Darbin-Watson coefficient, however, testifies to unforeseen variations in calculations. The reason is that factors connected with the currency's state of origin cannot be viewed as the main factors influencing the rate of exchange. International factors, which previously played a less important role, are now of unprecedented significance. This has weakened the connection between the exchange rate and the national economy and even gave England's TIMES newspaper reason to declare that "exchange rates no longer reflect ongoing economic processes in countries."[7]

The reason is that the currencies of the main capitalist countries, especially the American dollar, are used extensively in payments connected neither with the movement of goods and services nor with the currency's state of origin. The volume of international financial operations is now estimated at 150 billion dollars a day, and 90 percent of the operations are unconnected with the movement of goods.[8] The transfer of currencies from some TNC branches to others and speculative operations are having a substantial impact on exchange rates by changing the demand for currencies and their supply.

Another fact must also be considered. Most of the foreign debt of the developing countries is calculated in the American currency. The constant interest payments are also made in dollars. The growth of indebtedness increases the size of these payments and therefore constantly increases the demand for dollars. This powerful factor supporting the dollar is one of the reasons for its current strength and other developments in the monetary sphere. At the same time, the rising price of the American currency has automatically

increased the size of the debt, and the need for interest payments again increases the demand for the dollar. The result is a vicious circle in which the cause is the effect, and the nature of this relationship is almost a classic example of the philosophical "causa sui."

Some Western economists want to ignore the catastrophic effects of currency instability on the developing countries and try to shift the emphasis by discussing only the need for the freer exchange of goods. Criticizing this point of view, BUSINESS WEEK remarked, "the liberalization of trade will not help the Third World countries. What they really need is currency and price stability, and this is not secured by current U.S. policy."[9]

It is difficult to determine exactly how the dollar exchange rate is influenced by the variety of "uncontrolled" (that is, unconnected with the United States) payments (we will call them the factor of international transactions), partly due to inadequate methods for the statistical assessment of these payments. A sound statistical foundation has been laid only for the assessment of one such type of payments, namely international foreign trade transactions in dollars but unconnected with the United States. The methods described below can help to assess the effect of these payments on the exchange rates of other currencies.

International Transactions in Trade and the Dollar Exchange Rate

The assessment of the role played by such transactions in the contemporary monetary sphere necessitates the calculation of the proportion accounted for by individual countries and their currencies in international trade at the present time. To this end, we will examine several indicators.

First of all, there is the proportion accounted for by a state in international trade, which largely determines its influence in world exchange (see Table 1).

The United States is the leader in terms of these indicators. Whereas its percentage of world exports was relatively stable in the first half of the 1980's--around 12 percent, its significance as a world importer increased dramatically--to 17 percent in 1984. There were several reasons for this, including the rising cost of the dollar. The difference between the share of imports and share of exports increased substantially in recent years, attesting to the aggravation of the U.S. balance of trade.

In the second place, the foreign sphere, in turn, influences the national economy. The degree of this influence depends largely on how important foreign relations are to the country and how "open" its economy is. This is usually measured by an indicator of the proportion accounted for by national exports in the gross national product (see Table 2). According to these data, the U.S. export quota is low, and it is less vulnerable than other states to fluctuations in world market conditions.

In the third place, it is also significant that the scales of the use of different currencies in international transactions vary and do not always depend directly on a country's status in export and import operations (see Table 3).

Table 1. Proportion Accounted for by Various Countries in World Trade, %

Countries	1981		1982		1983		1984	
	Export	Import	Export	Import	Export	Import	Export	Import
United States	12.3	13.3	12.1	13.1	11.7	14.4	11.9	17.1
Japan	7.9	7.2	7.8	7.0	8.5	7.0	9.3	7.1
FRG	9.2	8.3	9.9	8.3	9.8	8.5	9.4	8.0
France	5.3	6.1	5.2	6.2	5.3	5.9	5.1	5.4
Great Britain	5.4	5.2	5.5	5.4	5.4	5.6	5.2	5.5
Italy	4.0	4.6	4.2	4.6	4.2	4.5	4.0	4.4
Canada	3.7	3.4	3.9	3.0	4.3	3.4	4.8	3.9

Calculated according to data in "International Financial Statistics," "National Institute Economic Review" for the corresponding years.

Table 2. Percentage of Exports in GNP of Various Countries

Countries	1981	1982	1983	1984
United States	7.9	6.9	6.0	5.9
Japan	13.2	13.0	12.7	13.7
FRG	25.6	26.6	25.7	27.8
France	17.6	17.0	18.7	21.5
Great Britain	20.0	19.9	20.0	21.9
Italy	21.5	21.2	20.7	21.2
Canada	24.8	23.5	23.3	26.7

Calculated according to data in "International Financial Statistics," "OECD Monthly Statistics of Foreign Trade."

The leader in international transactions is the U.S. dollar, which accounts for more than half of all world payments for exports and imports. The FRG also occupies an important place and accounts for more than 14 percent of these payments. The data on the Italian lira are largely hypothetical. Italy conducts virtually no operations in its own currency, although trade statistics are calculated in the lira.

All of this is closely related, in the fourth place, to the currency structure of the transactions of each individual country.[10] Table 4 shows that all countries make active use of the American currency in export and import payments. The figure is particularly high in import transactions, and the dollar even plays the decisive role for some countries--Canada, Japan, Italy and the United States itself. The national currency is used more actively for export payments, but the dollar plays the leading role for Canada, Japan and the United States.

Table 3. Use of Currencies in International Transactions, %

Currency	Exports	Imports
U.S. dollar	54.8	54.3
FRG mark	14.4	13.9
Pound sterling	7.5	6.9
French franc	6.1	6.4
Japanese yen*	2.7	0.1
Italian lira*	1.3	0.4

* Calculated on the basis of the use of the national currency in the trade of the given country, not counting its use by third countries.

Sources: NATIONAL INSTITUTE ECONOMIC REVIEW, November 1981, p 60; "Monthly Statistics of Foreign Trade" for corresponding periods.

Table 4. Currency Structure of Export and Import Operations of Various Countries (late 1970's and early 1980's), %

	Export		Import	
Countries	U.S. dollar	Own currency	U.S. dollar	Own currency
United States	98.0	98.0	85.0	85.0
Japan	61.5	32.7	93.0	2.0
FRG	7.2	82.3	33.1	42.8
France*	14.4	63.4	25.6	41.5
Great Britain	17.0	76.0	29.0	38.0
Italy	31.1	31.3	50.6	9.1
Canada	85.0	--	95.0	--

* Calculated on the basis of data in first two sources.

Sources: "International Financial Statistics"; "OECD Monthly Statistics of Foreign Trade" for corresponding periods; NATIONAL INSTITUTE ECONOMIC REVIEW, November 1981.

In this kind of analysis it is also important to consider the bilateral practice of transactions. For example, the American currency accounts for more than 70 percent of FRG imports from the United States, but only 13 percent of FRG imports from Japan.[11]

The correlation of currencies determines the degree to which rate fluctuations will influence the national economy. A currency used extensively in the country's transactions will have a greater influence. It is also important to bear in mind that exchange rates can fluctuate in different directions: The appreciation of one currency can be accounted by the depreciation of another.

This could nullify the impact, particularly if the currencies whose rates are moving in different directions occupy an approximately equal position in the structure of transactions.

Table 5. Degree of Control of Some Countries Over Their National Currency in Foreign Trade Operations of Late 1970's and Early 1980's, %

Countries	Export		Import	
	Controlled	Uncontrolled	Controlled	Uncontrolled
United States	21.5	78.5	22.7	77.3
FRG	54.2	45.8	25.5	74.5
France	54.1	45.9	38.2	61.8
Great Britain	54.7	45.3	29.1	70.9

Calculated according to data in "International Financial Statistics"; "OECD Monthly Statistics of Foreign Trade" for corresponding periods; NATIONAL INSTITUTE ECONOMIC REVIEW, November 1981.

The four indicators discussed above aid in calculating how much of the national currency of a country transcends the bounds of its use by the state of origin and is used by third countries, and therefore in clarifying the influence of the external sphere on the national economy. The results of calculations of this kind are presented in Table 5 and indicate the portion of the national currency controlled by the country of origin and the portion outside the control of national agencies.[12]

Therefore, more than three-fourths of all the dollars used in international trade are circulated without U.S. participation in transactions between third countries, and this weakens the United States' control of its own currency. It is possible, for example, that a change in the dollar exchange rate might be the result of large payments in American currency between OPEC and EEC countries, and not of U.S. monetary policy.

The increasing uncertainty in the currency sphere has motivated the leading capitalist countries to seek ways of coordinating their policies. Conferences of the heads of government of the "big seven" in Versailles, Williamsburg, London, Bonn and Tokyo confirmed this. The declarations issued at these times, however, have actually remained mere formal assurances. The problem is that the national priorities of each country often conflict with their collective international interests. The Western countries must make a choice: They can secure the stability of exchange rates, which will be in the common interest over the long range in principle but will require some sacrifices in the sphere of national policy, or they can reconcile themselves to the instability in the currency sphere and retain a free hand in national policymaking.

The stance of the United States is most indicative in this respect. Its reluctance to cooperation with other countries in the sphere of currency

relations has been duly noted in a bank bulletin, which said that "(Western--M. Ye.) Europe and Japan are more inclined than the United States to change their national policies in exchange for stable exchange rates."[13] This naturally gives rise to the question of why the state whose currency is circulated most extensively without its participation and is relatively less subject to national control rarely agrees to joint action to regulate its exchange rate.

The fact is that the dimensions of the American economy and the unique international position of the dollar generally allow the United States to derive more advantages from the use of national monetary levers than from the multilateral regulation of the currency sphere. The "dollar channel" in this case secures the influence, although indirect, of the United States on the economies of states using the American currency in their transactions. This was the case, for example, in the first half of the 1980's, when the higher interest rates in the United States and the rising exchange rate of the dollar attracted West European and Japanese capital, created serious difficulties for the economies of these regions and aggravated the foreign debt problem of developing countries.

Although substantial dollar assets are also outside the control of the United States, they are distributed among various countries. Other states can only influence the dollar seriously if they take coordinated action, and this is not always easy. This is why the Americans prefer to regulate the exchange rate of the dollar, even if less effectively (than if this were done jointly with other capitalist states), by itself, and, what is most important, exclusively in its own interest, or not to regulate it at all. The involvement of other countries in this process would make regulation more effective, but then the position of all of the parties involved would have to be taken into account, and this would be viewed by the United States as an infringement of its own interests. At the same time, as past experience has shown, Washington will cooperate with the West European states and Japan when this can solve some of its own problems. In particular, the policy emphasizing the spontaneous development of events in the currency sphere was pursued as long as the processes in this sphere were completely in line with the plans of the American administration. When the growth of the dollar began to threaten the U.S. economy by reducing the competitive potential of American goods, creating an unprecedented deficit in the balance of trade and weakening investment positions, the United States quickly intervened in conjunction with its West European partners to restrict the rise of the dollar exchange rate. In particular, banks in Japan, the United States, France, Great Britain and the FRG spent around 10 billion dollars between February and the middle of September 1985 to lower this rate.[14]

Although the steps that were taken to weaken the dollar lowered the exchange rate of the American currency, they were no help in solving other problems. In reference to this, the FINANCIAL TIMES remarked that "the decision made by the group of five countries on 22 September to coordinate their economic policies and accomplish the devaluation of the dollar still has not made enough of an impact from the standpoint of extremely necessary adjustments (improvements--M. Ye.) in the U.S. balance of trade."[15] And it is a fact that the

deficit in the American balance of trade reached the unprecedented figure of 139.7 billion dollars and the deficit in the balance of payments reached 114.2 billion in 1985 (see Figure 2).

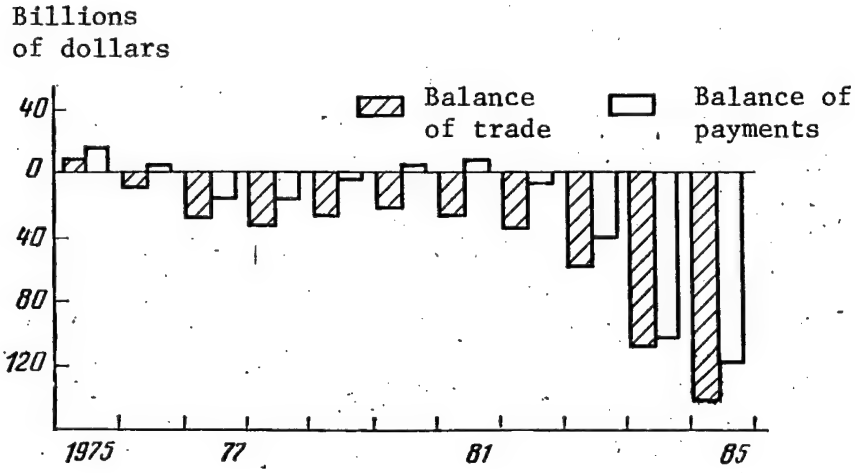

Figure 2. U.S. Balance of Trade and Payments

Source: FINANCIAL TIMES, 9 December 1985; THE ECONOMIST, 18-24 January 1986, p 92; 8-14 March 1986, p 98.

According to the FINANCIAL TIMES, the increasing strength of the American currency was the reason for three-fourths of the growth of U.S. trade balance deficit.[17] But this is only an estimate. It is obvious that this is the result of an entire group of factors affecting exchange rates--physical export and import volumes and export and import prices. What is needed is a more detailed analysis, which would reconstruct all of the multifaceted interaction of these factors.

The Effects of the Dollar Exchange Rate on American Trade

Some basic features of the effects of exchange rates on foreign trade were examined previously.[18] The model constructed at that time illustrated the effects of the currency sphere on trade in general and did not single out the important characteristics of the specific connections between these spheres. This is why the results of the previous analysis and all of the quantitative and qualitative assessments derived during the calculation process have been used as the basis for the next step--a simulation model illustrating how a given exchange rate changes basic indicators of foreign trade. During this stage of analysis, the primary considerations were the elasticity of export and import supply and demand and the reaction of the balance of trade to changes in exchange rates. Another factor considered was the type of cur-- rency--national or foreign--in which the contracted sum was calculated.

It is known, for example, that in principle devaluation results in larger sales of lower-priced export goods, reduced demand for higher-priced imports and a better balance of trade. In reality, however, the influence of devaluation on the balance of trade is more complicated. For example, the total value of sales of exports will increase only if the elasticity of demand for exports is greater than -1, or, in other words, if the percentage of increase in the physical export sales volume is greater than the percentage of decrease in prices. In the opposite case (that is, if elasticity is less than -1), the total value of exports decreases, and this weakens the positive impact of devaluation on the trade balance. If elasticity is equal to -1--that is, if the rise in the demand for exports is equal to the drop in prices--devaluation will have virtually no effect on the total value of exports.

In just the same way, the value of imports does not decrease after devaluation if the demand for them is not very vulnerable to changes in prices (that is, elasticity below -1). In this case, rising prices will not lead to a commensurate reduction of import purchases, and the total value of imported goods will therefore increase and have an adverse effect on the balance of trade. Even if the physical volume of imported goods decreases in proportion to the rise in prices, the influence of devaluation on the trade balance will have less impact because the value of imports will remain the same.

Various combinations of export and import supply and demand elasticity are possible, and these produce different results as far as the effects of devaluation on the trade balance are concerned.

A rise in the exchange rate of the national currency (revaluation) has the opposite result. Export goods are more expensive, they have difficulty competing with foreign goods, and sales drop. Purchases of cheaper (in national currency) import goods increase. The balance of trade becomes unfavorable. Even here, however, there are specific differences connected with different coefficients of demand and supply elasticity.

Our simulation model of the effects of fluctuations in the dollar exchange rate on U.S. foreign trade presents a more graphic illustration of this mechanism and of some other phenomena (see Table 6). The actual exchange rate of the American currency and the actual foreign trade indicators in 1977, 1980 and 1983[19] are compared with simulation data--that is, the indicators that would have been reached if, all other conditions being equal, the dollar exchange rate had remained unchanged during these years (the rate of the first quarter of 1975 was taken as the basis).

In 1977 the simulation rate is below the actual rate--that is, this is a case of artificial devaluation. The result is a dramatic increase in import prices calculated in dollars, because foreign exporters have to compensate for unfavorable changes in the rate. The increase in export prices in dollars seems extraordinary because devaluation promotes lower prices in principle. The increase is due to the higher cost of raw materials and other goods imported from abroad. But this figure is lower than the percentage of devaluation. Now foreign importers purchasing American goods will pay a smaller sum in their own currency, and this actually signifies a drop in the price of

American exports.[20] Whereas prior to the (artificial) devaluation, the cost of an export unit, according to our results, was

$$\frac{108.5}{100} \times \frac{102.7}{100} = 1.11 \text{ units of foreign currency,}$$

after devaluation the price was

$$\frac{111.6}{100} \times \frac{98.5}{100} = 1.09 \text{ units of foreign currency.}$$

Table 6. Simulation of Effects of Fluctuations in Dollar Exchange Rate on U.S. Foreign Trade (based on quarterly data)

	1977		1980		1983	
Indicators	Actual	Simulation	Actual	Simulation	Actual	Simulation
Rate of exchange (1975=100%)	102.7	98.5	94.5	98.5	120.0	98.5
Export prices (1975=100%)	108.5	111.6	156.0	151.1	165.3	176.5
Import prices (1975=100%)	112.9	122.6	187.3	172.3	181.3	216.7
Exports (in billions of dollars, in 1975 prices)	27.89	29.46	37.71	35.54	29.84	36.07
Imports ($ billions, 1975 prices)	34.83	33.23	33.50	35.35	32.29	31.47
Balance of trade (billions, current prices)	-8.20	07.85	-3.92	-7.17	-9.21	-4.55

There is a higher demand for the cheaper exports, and the volume increases from 27.89 billion dollars to 29.46 billion. Furthermore, whereas prior to the devaluation the total value of exports was 30.26 billion dollars

$$27.89 \times \frac{108.5}{100},$$

now the drop in prices has raised demand to a level at which the total value of exports, even at lower prices, rises to 32.87 billion dollars. This testifies that the elasticity of export demand is greater than -1. Imported goods are more expensive and the demand for them decreases, and to a lesser degree than prices have changed (consequently, the elasticity of import demand is equivalent to less than -1). For this reason, the total value of imports rises from 39.32 billion dollars

$$34.83 \times \frac{112.9}{100}$$

to 40.73 billion. As for the influence of simulated devaluation on the balance of trade, it is positive: The negative balance is reduced from 8.2 billion dollars to 7.85 billion.

In 1980 the simulation dollar exchange rate is higher than the actual rate, and this is therefore a case of artificial revaluation.

Predictably, the physical volume of exports is reduced, despite the slight drop in export prices calculated in national currency, because export prices in foreign currency will still increase, according to the model, after recalculation in accordance with the new rate of exchange,

from $\frac{156.0}{100} \times \frac{94.5}{100} = 147$ units of foreign currency, to $\frac{151.1}{100} \times \frac{98.5}{100} = 1.48$ units,

lowering the demand for U.S. export goods abroad. The reason is that now American exporters have to compensate for unfavorable changes in the exchange rate and raise the prices of their goods in foreign currency to cover their expenses.

Import volume increases because the lower import prices stimulate the demand for foreign goods in American markets. All of these changes have an adverse effect on the balance of trade.

The 1983 period confirms the natural tendencies connected with devaluation. Exports increase, imports decrease, and export and import prices change. Furthermore, just as in 1977, the rise in export prices in dollars is not as great as the percentage of devaluation, and this actually signifies a drop in the price of American products in foreign currency.

This model aids not only in the quantitative assessment of the overall influence of exchange rates on trade, but also demonstrates the specific features of the interaction of the currency and trade spheres. The tendencies revealed can also be seen when the effects of exchange rates on the trade of other capitalist states are analyzed (in particular, calculations of this kind were made for France), suggesting the relatively universal nature of these relationships. These calculations can also be used as the basis for forecasts of the effects of rate fluctuations on the foreign trade positions of the United States and other countries, and for more precise assessments of the nature and directions of changes in the balance of power in the world economy.

FOOTNOTES

1. K. Marx and F. Engels, "Works," vol 26, pt III, p 262.
2. "Politicheskaya ekonomiya. Slovar" [Political Economy. Dictionary], Moscow, 1983, p 43.
3. S. V. Gorbunov, "Valyutnyye kursy pri kapitalizme: problemy i protivorechiya" [Capitalist Currency Exchange Rates: Problems and Contradictions], Moscow, 1979, p 9.

4. K. Marx and F. Engels, Op. cit., vol 25, pt II, p 133.

5. FINANCIAL TIMES, 16 December 1981.

6. Forecasts of currency exchange rates are usually based on autoregressive equations calculated with the rates of previous periods. These calculations are particularly important in short-term forecasting. For example, the author constructed the following autoregressive equation of the second order (based on weekly data for 1981-1982) to forecast the exchange rate of the pound sterling to the dollar:

$$ER_t = 0.493ER_{t-1} + 0.411ER_{t-2} - 0.031I_{US-UK} + 0.01$$
$$\quad\quad (3.8) \quad\quad (3.3) \quad\quad (3.3)$$
$$R^2 = 0.949;\ DW = 2.09,$$

where ER_{t-1} signifies the rate with a 1-week lag,
ER_{t-2} signifies the rate with a 2-week lag,
I_{US-UK} signifies the difference between interest rates in the United States and Great Britain with a 10-week lag.

The equation shows that a change in the pound/dollar exchange rate of 1 unit over the past week led to a change of 0.49 units in the current rate. A change of 1 unit in the rate with a 2-week lag led to a change of 0.41 units in the current rate (that is, the influence obviously grows weaker with time). The minus sign in front of the difference between interest rates indicates a previously noted tendency: A rise in rates in the United States in relation to rates in Great Britain causes capital from Great Britain to enter the United States and weakens the position of the English pound.

In general, the equation has a high determinant coefficient and a good Darbin-Watson coefficient, attesting to a fairly accurate description of the interaction of these elements. We should add that the results of the calculations of this equation without interest rates were less satisfactory. When the indicator of the difference between interest rates was added to the group of factors, the equation improved (for the methods of constructing mathematical models illustrating the interrelationship of currency exchange rates and foreign trade, also see SSHA: EPI, 1985, No 8, pp 125-127).

7. THE TIMES, 7 October 1982.

8. MEMO, 1985, No 8, p 139. Marx quoted an absolutely accurate, in his opinion, remark by 19th-century English bourgeois economist W. Newmarch, that "the rate of exchange between two countries is influenced--perhaps exclusively--by the supply of bonds and bills of exchange in one country in relation to the supply in the other country; this is the rational theory of the rate of exchange" (K. Marx and F. Engels, Op. cit., vol 25, pt II, p 127).

9. BUSINESS WEEK, 11 June 1984, p 17.

10. When the currency structure of trade on the global level and on the level of individual countries is analyzed, difficulties of an informational nature often arise. Statistics in these areas are uncoordinated, information is sometimes delayed for 3 or 4 years and its use is possible only in a situation in which the currency structure correlation is a relatively stable quantity and does not display significant changes over a few years. Data of this kind for some countries are unavailable. For this reason, the figures cited in the works of various economists are sometimes estimates and sometimes the result of an analysis of related indicators.

11. P. Kenen, "The Role of the Dollar as an International Currency," N.Y., 1983, No 13, p 22.

12. The results were obtained in the following manner. First the country's average share of world trade and the use of the given currency in international payments in 1981-1984 were compared, and this was then used as a basis for the calculation of the use of the given currency by its country of origin. The indicator derived in this way, however, reflects the use of the national currency in a situation in which 100 percent of the contracts of the state of origin are calculated in this currency. For this reason, the figure was then adjusted in line with the currency structure of each country's transactions (see Table 4).

13. "Banca Nazionale del Lavoro Quarterly Review," December 1984, p 428.

14. FINANCIAL TIMES, 16 September 1985.

15. Ibid., 15 November 1985.

16. ECONOMIST, 18-24 January 1986, p 92; 8-14 March 1986, p 98; according to some estimates, the equalization of the U.S. balance of payments by 1989 will require an annual decrease of 10-12 percent in the exchange rate of the dollar (FINANCIAL TIMES, 16 September 1985).

17. FINANCIAL TIMES, 15 November 1985.

18. SSHA: EPI, 1985, No 8, pp 121-127.

19. These years were chosen because the dollar was weakened in the crisis year of 1980 and grew stronger in 1977 and 1983--years of more active business conditions.

20. In the case of American exports, we have to view currency correlations from the importer's standpoint because most U.S. exports are paid for in dollars, and the foreign purchaser of U.S. products must determine the amount of national currency he has to spend to acquire the necessary number of dollars.

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CANADIAN PUBLIC OPPOSITION TO SDI PARTICIPATION VIEWED

Moscow SSHA: EKONOMIKA, POLITIKA, IDEOLOGIYA in Russian No 10, Oct 86 (signed to press 15 Sep 86) pp 58-65

[Article by Ye. V. Israelyan: "The Canadian Public's Struggle for Peace and Disarmament"]

[Text] "Forces for peace and progress throughout the world can neutralize the imperialist threat, keep the world from sliding over the edge of the nuclear abyss and prevent the transformation of outer space into a battlefield," a 27th CPSU Congress resolution says.[1]

The peace movement in Canada is making an impressive contribution to the struggle to prevent a nuclear catastrophe and curb the arms race. The formation of the Canadian Alliance for Peace, a national coalition uniting virtually all opponents of the arms race, in November 1985 attested to the maturity and militance of this movement. The first test of the alliance's strength was the campaign against Washington's "Star Wars" in February-October 1986. Peace-loving forces in the country resolutely opposed Canada's involvement in the SDI and the cooperation of Canadian firms with the Pentagon on this program and severely condemned the U.S. intention to stop observing the provisions of the SALT II treaty. They decided to make 1986, declared the International Year of Peace by the United Nations, a period of struggle for significant positive changes in world politics and for the effective reduction of nuclear arsenals.

Let us take a look at the distinctive features of the peace movement in Canada, its social base, its main slogans and the results of its struggle for peace in the 1980's.

Any discussion of the distinctive features of the Canadian peace movement's origins and development should begin with some words about this country's attitude toward nuclear weapons. It does not have any, despite the fact that it does have everything it takes to develop and build them. Furthermore, as a result of its cooperation with the United States and Great Britain on the Manhattan Project (the atomic bomb project), Canada had a nuclear reactor by the end of World War II and could have used it to produce weapons even then. The Canadian leadership decided, however, not to create a nuclear arsenal of its own and announced this decision in the beginning of 1946. Canada's

unilateral refusal to join the "nuclear club" and its retention of its non-nuclear status throughout the postwar period nurtured the national pride of Canadians. The U.S. efforts to involve Canada in the American first-strike strategy in the 1980's, such as the testing of American cruise missiles in Canada, were viewed there as flagrant violations of Canada's non-nuclear status and aroused vehement public objections. For this reason, the peace movement in Canada, which has the same anti-nuclear aims as the peace movement in other countries, is specifically demanding that the country be declared a nuclear-free zone and that it not be used any longer as a testing-ground for U.S. nuclear missiles.

Canada's unique military-strategic position was another factor contributing to the growth of antiwar feelings in the 1980's. This country is located between the two largest nuclear powers--the USSR and the United States--and resembles what former Prime Minister L. St. Laurent (1948-1957) called the "filling in the sandwich." Close Canadian-American military cooperation within the NORAD system of collective aerospace defense became a direct result of geographic proximity to the United States and the common class interests of ruling circles in the two countries. Canada's participation in NORAD means that it will certainly be drawn into any future nuclear conflict. Now that the aggressive U.S. policy line of the 1980's is increasing the danger of war, this prospect is seriously worrying the Canadian public.

The nature of the campaign for peace is indisputably affected by the general state of Canadian-American relations. One of the distinctive features of the Canadian peace movement is its development in an atmosphere of widespread dissatisfaction with U.S. policy toward Canada. Indignant feelings about the reckless foreign policy line are being intensified by Washington's intractability in various spheres of Canadian-American relations (exports of Canadian goods and power engineering). This is why the anti-nuclear appeals of Canadians are increasingly likely to be combined with the demand that Canada's government strengthen the country's economic and political independence.

The unique legal structure of the Canadian Government must also be taken into account. It is distinguished by a highly decentralized system of political authority and highly independent provinces. One result of this is "regionalism" in public affairs and public opinion. This is also why democratic movements develop primarily on the local level, remaining within the boundaries of various provinces and cities. From the very beginning, the Quebec Peace Council's contacts with the Anglo-Canadian peace movement were too weak. The aggravation of the French-Canadian issue in the 1970's weakened these ties even more. In connection with this, the problem of consolidation and united action, which is being faced by the peace movement in all countries, is particularly acute in Canada.

The old tradition of public peace movements has been of great significance in the development of the struggle for peace in Canada. Canadian advocates of peace have been active in international peace campaigns throughout the postwar period. The earlier stages of the struggle laid the basis for its growth in the 1980's: This is when many of the organizations involved in the current campaign were founded, and when activists and other members acquired extensive practical experience.

Today's peace movement in Canada rests on a broad social base. It has been joined by members of all classes and social groups and of various parties and by people with various political and ideological convictions and religious beliefs.

The scientific intelligentsia has made a tremendous contribution to the campaign. Its members have been particularly active in opposing Canada's participation in the "Star Wars" program. Prominent scientists--physicist J. Poliany and physicianst and president of the Science for Peace organization D. Paul, experts on arms limitation W. Epstein, journalists--for example, E. Reger, one of the leaders of the Project Orala peace organization--and many others have proved conclusively that the ABM system with space-based elements envisaged in the SDI is not intended for defense against a nuclear attack, but for the neutralization of a retaliatory Soviet strike after a U.S. nuclear attack. For this reason, the creation of this system would be a significant part of the American first-strike strategy, particularly under the conditions of the massive U.S. offensive arms buildup. According to Canadian experts, the work on the "Star Wars" program will dramatically increase the significance of the Canadian Arctic in the detection and interception of the Soviet bombers and cruise missiles capable of counterattack after a U.S. nuclear attack. This will mean the further involvement of Canada in Washington's nuclear plans, and this threatens Canadians with a national catastrophe.[2]

Many economists have logically refuted the arguments of those who support Canada's participation in the SDI and allege that it will derive economic advantages from this. The critics of the SDI have pointed out, first of all, that it will be extremely difficult for Canadian firms to compete for "Star Wars" contracts with West European and American companies. Secondly, in view of the strict secrecy of SDI research, Canadians will have virtually no access to information about the latest technology. Finally, a study conducted by a group of economists from the Science for Peace organization proved the groundlessness of the thesis that participation in the SDI will secure employment in Canada. They calculated, in particular, that only around 1,000 jobs would be created in the next 5 years.[3] Given the almost 1.5 million unemployed Canadians, this will not solve the problem, especially since most of the potential jobs would be in high-technology branches, where the problem is not as acute as in traditional sectors.

Canadian scientists also stress that cooperation with the United States on the "Star Wars" program would inevitably increase Canada's already excessive dependence on its southern neighbor in matters of war and peace and in various spheres of bilateral relations. The lawyers belonging to the Lawyers for Social Responsibility peace organization, such as D. Wright, have pointed out the fact that an ABM system with space-based elements would be a clear violation of the 1972 Soviet-American Treaty on the Limitation of ABM Systems.

All of these considerations motivated members of the scientific community to send a petition to the Mulroney government in spring 1985 to protest the plans for the militarization of outer space and the prospect of Canadian participation in them. The petition was signed by more than 1,300 teachers, engineers, designers and scientific personnel who refused to participate in SDI research.[4]

Prominent specialists, particularly Executive Director J. Lamb of the Canadian Center for Arms Control and Disarmament, refuted Washington's statements about Soviet "violations" of strategic arms limitation agreements. According to the center, the Soviet Union has scrupulously adhered to the quantitative limits stipulated in the SALT II treaty. The Canadian experts have stressed that the White House's refusal to observe agreements will create an extremely disturbing situation in the world and will start a new round of the arms race. Under present conditions, Canada, in their opinion, can and should put forth its own initiatives and exert positive influence on the United States with the aim of changing the U.S. position on arms limitation.[5]

Canadian workers have been increasingly active in the peace movement. Such influential labor unions as the United Electrical Workers, United Automobile Workers and Union of Postal Workers have participated energetically in the movement from the very beginning. In spring 1983 there was a significant change in the position of the leaders of the country's largest labor organization--the Canadian Labor Congress (CLC)--when they decided to support the peace movement. The organization joined the new Peace Caravans Petition coalition of peace organizations.

The development of positive tendencies in the CLC leadership's approach to the issues of war and peace was attested to by the decisions of its 16th congress in April-May 1986. Its resolution stressed that the struggle for peace is one of the most important jobs of the Canadian labor movement. Congress documents contain the demand that Canada refrain from participating in the Pentagon's "Star Wars," that the Canadian-American program of joint arms production be curtailed, that Canada withdraw from NATO and that its military industry be converted for civilian needs. In this way, the CLC leaders confirmed their departure from their previous mistaken idea that the military programs were of economic benefit to labor. Congress delegates, including S. Carr, the newly elected president of the CLC, advocated the restoration of congress relations with central trade union bodies in the USSR and other socialist countries. The congress also decided to join the leadership of the Canadian Alliance for Peace. The head of the United Automobile Workers, R. White, was elected CLC representative to the alliance.[6]

The participation of the largest labor organization in the struggle for peace distinguishes the Canadian peace movement from the American one. The leaders of the AFL-CIO have never joined the anti-nuclear campaign of American labor. The working class in Canada, however, is still not playing the kind of active and guiding role in today's peace movement as the working class in Western Europe plays. This is specifically attested to by the following fact. No Canadian labor union opposing nuclear war has employed the class methods of struggle used by West European labor unions. Not one antiwar strike has been undertaken in Canada to date.

Canadian communists are actively mobilizing the masses for the struggle against the danger of nuclear war.[7] They have analyzed the present international situation thoroughly and in depth, blaming imperialism in the United States and other Western countries for the escalation of tension in the world. The CPC has resolutely supported the Soviet program for the elimination

of nuclear weapons by the end of the century, set forth in M. S. Gorbachev's statement of 15 January 1986, and other sweeping foreign policy initiatives adopted by the 27th CPSU Congress. Speaking at this congress, CPC General Secretary W. Kashtan said: "Your program of action will have a profound effect...on the entire course of world events."[8] Canadian communists have demanded that their government put an end to the mass media's silence on the Soviet proposals and secure their broadest possible publication and discussion.

The Canadian campaign for peace in the 1980's has been distinguished by extensive antiwar activity by churches. In spring 1985 the Council of Canadian Churches asked the Mulroney government to refuse to participate in the "Star Wars" program. The council called the SDI politically and economically unsound and inhumane.[9] It is significant that the current peace campaign has been joined not only by the traditionally pacifistic religious communities, such as the Quakers, but even by a church as conservative as the Catholic Church.

Peace slogans have also been supported by some members of the political elite with a great deal of prestige in ruling circles. They include W. Gordon, one of the most famous men in the Liberal Party and the minister of finance in the Pearson government. He has insisted that Canada must withdraw from NATO and NORAD, declare itself a nuclear-free zone and stop all nuclear tests. G. Ignatieff, now the president of the University of Toronto and previously a prominent Canadian diplomat who served as Canada's ambassador in charge of disarmament issues in 1984, has also demanded Canada's refusal to participate in NORAD and support for the Soviet idea of "Star Peace." He has been joined by part of the Canadian Parliament--120 members of the Senate and House of Commons belonging to Parliamentarians for World Order. They have advocated the creation of a nuclear-free zone in Canada.

Some members of Parliament have commended the Soviet program for the complete elimination of nuclear weapons by 2000. For example, J. Chretien, a member of the House of Commons from the Liberal Party, called the Soviet proposals constructive and said they warranted careful consideration.[10] Statements by members of the political elite in favor of peace have involved Canadians with moderate and conservative views in the campaign.

Members of the Canadian business community are also realizing that only the preservation and reinforcement of international detente can give them the freedom of action they need to attain their own goals, which often do not coincide with the goals of the American bourgeoisie. In Canada, in contrast to the United States and Western Europe, this realization has not led to the support of the peace movement by businessmen. In the United States, with its colossal military budget, the demand for the redirection of federal resources from military to civilian needs has won the approval of some members of the monopolist bourgeoisie with a strong interest in the domestic market, who have lost part of their profits in the arms race and are therefore opposed to the military-industrial complex.

Farmers, agricultural workers and the most progressive members of racial and ethnic minorities have become involved in the movement to stop the arms race

because they associate the struggle for peace with the movement against racism and for socioeconomic reform. For example, the Canadian Association of Metis and Indians wants to stop the tests of American weapons on the Primrose Lake testing site near their homes.

The participation of people with vastly different levels of class consciousness, social origins, religious beliefs and levels of education in the peace movement complicates the cooperation of peace organizations. Besides this, the consolidation of these forces is being seriously impeded by the existence of separate peace movements in English- and French-speaking Canada.

Differences in the programs of Canadian organizations have given rise to additional difficulties. For example, for some of them, such as the Send the Cruise Missiles Back group, the termination of the tests of American missiles in Canada is the final aim of their protests. The Canadian Peace Congress and Women's Voice, however, are insisting on the revision of all Canadian foreign policy, the pursuit of an independent foreign policy and withdrawal from NATO and NORAD. The Toronto Disarmament Network also plays a perceptible role in the movement and wants to prevent Canada's participation in the "Star Wars" program. The increasing support for this slogan is attested to by the following fact: The coalition's membership almost doubled in just over 2 months--from May to July 1985.[11] Several peace organizations, such as the Canadian Peace Congress, Physicians for Social Responsibility and the Toronto Disarmament Network, actively support the Soviet program for the elimination of nuclear weapons. R. Penner, the head of the Toronto group, called the Soviet proposals a major contribution to the cause of disarmament.[12]

The forms of activity of peace organizations are just as diverse. They include rallies, demonstrations, peace marches, the circulation of petitions and the composition of letters and telegrams to the prime minister. For example, the government received over 5,000 letters from people who insisted on its refusal to participate in the "Star Wars" program. Antiwar feelings found a new form of expression in the referendums on disarmament initiated by the Disarmament Is Our Goal organization. These referendums were held in 192 Canadian cities during municipal elections in 1982-1984. The election results indicated that 70 percent of the Canadians are in favor of nuclear disarmament.

Therefore, a contradictory situation has taken shape in the Canadian peace movement. Its diverse social base and its broad range of slogans and forms of action, which represent the movement's strong points, are also the reason for its heterogeneity, ideological conflicts and lack of organizational unity. A year ago, just before the Canadian Alliance for Peace was formed, there were more than a thousand groups and organizations in the country, the actions of which were poorly coordinated and were largely spontaneous. All of this reduced the effectiveness of the movement considerably and made it easier for ruling circles to influence it. With a view to this, the organizers of the antiwar campaign took several steps to unite forces for peace. The most important was the constituent conference of the Canadian Alliance for Peace in November 1985.

The forum was attended by delegates from leading peace organizations and groups in the country, such as the Canadian Peace Congress, Project Orala, Women's Voice, Physicians for Social Responsibility and Disarmament Is Our Goal, and from the largest labor organizations--the Canadian Labor Congress, the Alberta Federation of Labor and others. The issue of Canada's participation in the "Star Wars" program was the central topic of discussion.

A policy document, entitled "Declaration of Unity," was approved at the forum. It listed the main goals of the alliance: the involvement of the Canadian public in the world movement for disarmament; a nuclear freeze, the cessation of nuclear proliferation and the prevention of the militarization of space; the declaration of Canada a nuclear-free zone; the transfer of resources in military production to civilian needs; the dissolution of military blocs and the pursuit of an independent Canadian foreign policy.[13]

The formation of the alliance, which was joined by virtually all of the main peace organizations and groups, and its policy document reflected the desire of peace activists for consolidation and united action. Another one of the conference's successes was the resolute refusal of the majority of participants to include a statement about the "equal responsibility" of the USSR and the United States for the nuclear arms race in the policy document. This was proposed by members of some organizations.

The provisions of the program pertaining to the functions of the alliance, however, were largely of a compromise nature. They essentially consisted in informing peace organizations of projected undertakings, arranging for the exchange of information among various peace groups, discussing the current affairs of the movement and promoting collective action. The program stresses that the alliance's role consists in supporting the undertakings of some or all of the groups making it up, and not in holding campaigns of its own. For this reason, as progressive groups noted, the conference was an extremely important phase, but only the initial one, in the process of the creation of a truly effective coalition. This process will depend on the further consolidation of forces for peace in the country.

Recent events have indicated that the peace movement's main demands have not been satisfied--the cancellation of tests of American cruise missiles in Canada, the declaration of a nuclear-free zone, the complete refusal to participate in the SDI and the introduction of changes into the NORAD agreement. The results of public activity, however, have been impressive.

Above all, peace demonstrations have influenced the decisionmaking process in the sphere of foreign and military policy. There is no doubt, for example, that public pressure forced Ottawa to refuse to participate directly in the "Star Wars" program. It is no secret that the Canadian Government was one of the first (back in January 1985) to express approval of the United States' SDI-related research. Statements by E. Nielsen, then minister of national defense, and other Canadian officials after Reagan's meeting with Mulroney in March that year attested to the government's intention to involve Canada in the "Star Wars" program. Only the active and resolute resistance of these plans by peace organizations, labor unions, politicians, public spokesmen,

scientists and military experts forced the government to take an ambiguous stand. On the one hand, it declined Washington's invitation to participate in the SDI, but on the other, it authorized cooperation by private companies with the United States on the "Star Wars" program. In this way, Canada took the same position as some other Western countries (France, Greece and Denmark), which had also refused to participate directly in the plans for the militarization of space and intensified the disagreements in NATO over the "Star Wars" issue.

During heated political discussions of the "Star Wars" issue in spring and summer 1985, the Liberals opposed Canada's direct participation in the SDI. The report of a select working group created by the Liberals stressed that this kind of cooperation would be inconsistent with Canada's main goal in the international arena--arms limitation. The authors of the report recommended that the government aid in the development of space potential exclusively for peaceful purposes.[14]

Under the conditions of increased activity by progressive forces, the New Democratic Party substantially expanded and supplemented its antiwar program. Its congress of June 1985 requested Canadian refusal to participate in the "Star Wars" program, the cancellation of tests of American cruise missiles within the territory of the country and in its airspace and the transformation of Canada into a nuclear-free zone.

The New Democrats advocate Canada's withdrawal from military blocs and the cancellation of the American-Canadian joint arms production program. Parliamentarians from the NDP took more energetic action when the NORAD agreement expired in March 1986. Pointedly criticizing this agreement, the New Democrats insisted on an amendment stipulating that participation in the agreement would not obligate Canada to contribute to the creation of an ABM system with space-based elements. The NDP leadership commended the creation of the national Peace Caravans Petition coalition and joined its executive committee.

The peace movement is also influencing the position of the federal Parliament. In June 1986, for example, the parliamentary Committee on Foreign Policy and National Defense expressed support for the USSR's unilateral moratorium on all nuclear tests and asked Ottawa to urge a similar U.S. move. Parliamentary deputies also asked the government to pursue a more independent policy on disarmament.[15]

Another result of the activities of forces for peace--the change in the domestic political situation in Canada--is also of indisputable significance. The active participation of local government agencies in the discussion and resolution of problems of war and peace is a qualitatively new development. For the first time, municipal government agencies in Canada are expressing their own opinions on matters of military and foreign policy by passing resolutions demanding the cancellation of tests of American cruise missiles in Canada and a freeze on USSR and U.S. nuclear arsenals. The growing strength of the peace movement was quite eloquently confirmed when more than 90 municipal governments, including the governments of such large cities as Toronto,

Vancouver and Regina, declared their territories nuclear-free zones. A whole province--Manitoba--has also claimed nuclear-free status.

Therefore, the movement against militarism and war in Canada clearly displays tendencies common to peace movements throughout the world today. In addition, it has its own distinctive social base and forms and methods of protest and its own slogans and demands. There is every reason to believe that the movement against militarism will continue to serve as an important factor in Canadian domestic and foreign policymaking in the future. The degree of its influence, however, will depend largely on the unity of forces for peace and on the organizational work of the Canadian Alliance for Peace. When CPC General Secretary W. Kashtan assessed the association's first steps in his speech at the 27th CPSU Congress, he expressed the certainty that the formation of the alliance would "promote a more active struggle for peace and for an independent Canadian foreign policy."[16]

FOOTNOTES

1. "Materialy XXVII syezda Kommunisticheskoy partii Sovetskogo Soyuza" [Materials of the 27th CPSU Congress], Moscow, 1986, p 100.
2. THE PLOUGHSHARES MONITOR, June 1985, pp 2-4.
3. Ibid., p 5.
4. THE PEACE MAGAZINE, June 1985, p 16.
5. THE GLOBE AND MAIL, 8 June 1986.
6. CANADIAN TRIBUNE, 12 May 1986.
7. V. P. Svetlanov, "Canadian Communists in the Struggle for Peace and Labor Interests," SSHA: EPI, 1985, No 9--Ed.
8. PRAVDA, 6 March 1986.
9. THE GLOBE AND MAIL, 25 July 1985.
10. "House of Commons Debates, 20 January 1986," p 83.
11. "Brief from the Toronto Disarmament Network," Toronto, July 1985.
12. CANADIAN TRIBUNE, 17 January 1986.
13. PEACE NEWS, Winter 1985/86.
14. THE GLOBE AND MAIL, 13 July 1985.
15. Ibid., 6 June 1986.
16. PRAVDA, 6 March 1986.

STATUS OF THE SDI PROGRAM REVIEWED

Moscow SSHA: EKONOMIKA, POLITIKA, IDEOLOGIYA in Russian No 10, Oct 86 (signed to press 15 Sep 86) pp 66-69

[Article by M. I. Gerasev]

[Text] The work on the "Star Wars" program in the United States has been accompanied by a campaign of uninterrupted propaganda from the administration, the program's Defense Department administrators and various organizations on the far right. However, whereas political and military-strategic arguments were the focal point of the campaign immediately after President Reagan's famous statement of 23 March 1983,* purely technical arguments--or, more precisely, publicity about "rapid progress in the work on virtually all of the main subsystems and components" of the ABM system--subsequently became more prominent.

There are several reasons for the changes in the official arguments cited to justify the SDI program. First of all, it has become quite obvious that the arguments about the "stabilizing effect" of the broad-scale ABM system and about the system's alleged ability to promote rapid and fundamental progress in the sphere of nuclear disarmament were based on quite primitive logic that could not stand up to serious analysis and criticism.

Secondly, the allegations about the "rapid progress" of the work on the SDI program are supposed to refute the numerous and carefully substantiated doubts expressed in recent years by many prominent American scientists with regard to the technical feasibility of the program.

Thirdly, the publicity surrounding achievements in the development of elements of the ABM system clearly reflects the American leadership's hope of deriving political dividends from the SDI program even during the initial stages of the work on it, particularly the hope of involving the NATO allies more actively in this work and of exerting pressure on the Soviet Union in the Geneva talks.

Finally, the most important consideration resulting in the change of emphasis in SDI propaganda is indisputably the desire of the program's administrators

* SSHA: EPI, 1985, No 11, pp 15-25--Ed.

to create the kind of atmosphere in the American Congress that will secure the unimpeded approval of the rapidly growing allocations for the program. The administration request for almost 5 billion dollars for the SDI program in fiscal year 1987 has been submitted to the congressmen and senators. If the request is approved, this will be the Pentagon's largest current military program.

This has caused many American legislators, even those not numbering themselves among the SDI's opponents, to be somewhat wary of the recent statements by program administrators about the "major technical breakthroughs" in the work on virtually all of the main elements of the SDI.

A report prepared by staffs of senators W. Proxmire, B. Johnston and L. Chiles is indicative in this respect. It is an attempt at an independent analysis of technical problems in the work on the SDI and the actual state of the work at the present time. This report is primarily based on the authors' personal contacts and conversations with a group of the program's leading specialists. This distinguishes it from many earlier publications by the SDI's critics, who generally had no direct connection with it.

In general, the report concludes that, in spite of some progress in the last 2 years and some perceptible advances in a few areas, the results cannot be categorized as "technical breakthroughs" with a major impact. Furthermore, according to the authors, the current level of the technical work on some elements of the program testifies that difficulties in future projects could be much more significant than anticipated.

The authors mention the highly vulnerable state of major space-based elements, especially the first-echelon combat stations of the ABM system, which are supposed to intercept ballistic missiles in flight, as one of the most serious and fundamental problems for which no satisfactory solution has been found. The report says that, in the opinion of the overwhelming majority of experts, the difficulty of securing the invulnerability of space combat stations is a much greater problem than the achievement of the necessary technical parameters in weapons for the destruction of ballistic missiles, and many feel that there is no satisfactory technical solution, because the potential adversary could employ a broad range of active countermeasures. It is indicative that this is the opinion of specialists now taking a direct and active part in the work on the SDI.

The report specifically mentions "space mines"* and various ground-based anti-satellite systems, including directed-energy systems, as the most effective and simplest means of counteraction. The authors remark that not one of the specialists they consulted could suggest a satisfactory way of defending the ABM system's combat stations against "space mines." The report also expresses the opinion that the newest weapons systems now being developed, such as

* Satellites equipped with powerful explosive devices and launched into orbits with parameters approximating those of the orbits of the space combat stations.

lasers or neutral particle accelerators, could ultimately serve more effectively as antisatellite weapons than as weapons for the interception of ballistic missiles.

On the basis of these facts, the authors conclude that all of the previously considered ways of securing the invulnerability of space combat stations now seem obviously inadequate. This situation prompted many of the specialists who were consulted to finally recall the existence of another way of solving difficult politico-military problems--the negotiation and conclusion of agreements. Through the distorted logic that is characteristic of the supporters of the SDI program in general, however, these specialists advocate the kind of international legal standards that would guarantee the inviolability of the ABM equipment in space.

Some of the specialists who were surveyed when the report was being prepared recommended the complete abandonment of the plans to deploy the first-echelon ABM elements in space and a transfer to the use of so-called pop-up systems for the interception of missiles in the ballistic phase of their trajectory. This, however, would give rise to a multitude of additional problems, including the same problem of securing the invulnerability of, for instance, the submarines that might serve as the launching pads for systems of this kind.

In addition, this would require more effective means of detection, identification and plotting in the ballistic portion of the trajectory, and the work on these, according to the authors of the report, has not produced any satisfactory results to date. In particular, they point out the fact that all earlier estimates of the probable number of warheads and decoys were much too low because, according to Livermore Laboratory specialists, the use of a missile carrier with a booster by the adversary, which is considered one of the most effective ways of surmounting the first echelon of the ABM system, will not, as was previously assumed, substantially reduce the ICBM payload. There is also the possibility that attack missiles could be equipped with several abbreviated phases, which would complicate the reliable detection and identification of targets even more.

The authors state that previously considered methods of passive target identification, particularly the optical long-wave infrared sensors with heightened resolution, are unlikely to be effective enough in a real combat situation. This point of view, the report says, is shared even by the head of the SDI organization, J. Abrahamson, and many other specialists directly involved in the project. They are now stressing the need for the stepped-up development of active means of identification, presupposing the use of low-energy lasers or particle beams. This equipment, however, is in such an early stage of development that no unequivocal conclusions can be drawn with regard to its use and effectiveness.

The authors of the report believe that the development of a space transport system for the deployment and subsequent maintenance of the space elements of the ABM system is another major problem. All estimates of economic indicators of the SDI program to date have essentially pertained to the cost of the main combat subsystems: the means of intercepting, tracking, detecting

and identifying targets and equipment for combat command and control. The transport problem, however, could be at least as difficult and costly, if not more so.

The spacecraft the United States has today cannot meet the economic and technical demands of the space ABM system. The problems in this area became particularly apparent after the "Challenger" disaster.

According to estimates cited in the report, putting the main elements of the ABM system in orbit could take from 600 to 5,000 shuttle flights. The cost of this kind of program at today's prices would range from 30 billion to 600 billion dollars. Even if the cost of putting a payload in orbit should drop to 500-1,000 dollars a kilogram in the future, as the SDI's supporters maintain, the cost of transporting the elements of the broad-scale ABM system would still be too high.

Excessive costs are not the only problem in the transport program. According to W. Lucas, the former director of the NASA space flight center, 166 of the structural space elements of the ABM system are too large or too heavy to be carried by the shuttle.

Various designs of new heavy space vehicles and so-called "orbital planes" are now being considered in the United States for the SDI. These systems will probably be ready for use only in the next century.

The problems discussed above are far from a complete list of all the difficulties that are now being encountered in the work on the SDI program, despite the widely publicized statements of its supporters about the "exceptionally successful development of the program." The report specifically mentions the great difficulties in the development of the main element--the means of destroying ballistic missiles--which is resulting in the gradual reordering of program priorities. For example, the chemical infrared lasers and neutral particle accelerators previously envisaged as the main means of destruction are no longer being viewed from this standpoint, and the work on them is being continued only for the purpose of using them in the development of active means of identifying targets in the ballistic phase of the trajectory. There is still a great deal of uncertainty about the effectiveness of other offensive elements of the system.

In spite of the fact that the program's administrators have publicly stated that the reordering of priorities is primarily a result of financial restrictions imposed by Congress in previous years, the authors of the report believe that these changes are mainly the result of technical difficulties. They stress that advances in the work on the program will be accompanied by the accumulation of problems that could impede its further development in the future.

Besides this, the current development strategy, based on previously scheduled dates for the demonstration of the main prototypes and the need for a political decision in the early 1990's on the further development of the system, cannot, in the opinion of the authors of this report, contribute to the

successful resolution of new technical problems. The rigid schedule contradicts the administration's statements about the "research nature of the SDI" and will force the creators of the system to strive to demonstrate certain technical achievements on schedule and ignore the central issue of the creation of an interrelated and effective system.

In general, however, the appearance of this report is extremely indicative and testifies to the increasing uneasiness in the U.S. Congress about the "Star Wars" program.

"We would like to hope that realism and a recognition of the need to work together to find ways of improving the international situation and stopping the senseless arms race will prevail in American plans and actions," M. S. Gorbachev said in a speech on Soviet television. "After all, in essence, the worst thing about the SDI is that it undermines the prospects for negotiations and expands the zone of mistrust."

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U.S. X-31 SPACE PLANE DESCRIBED

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[Article by I. N. Mosin: "The Pentagon's Aerospace Plane Project"]

[Text] This word is as new as the final product of the project, envisaging the creation of an airplane and spaceplane in a single system. Many American companies have been working on this idea for several years. The results of their preliminary designs and calculations allowed President Reagan to announce the new aerospace plane program and to call it an "important primary objective" in his state of the union message in February (1986). According to reports in the American press, the government has already begun awarding research contracts to the largest aerospace companies through NASA and the Pentagon. These contracts are viewed as the first step in the actual development of the plane.

What will the project entail? President Reagan demonstrated a model of the aerospace plane at the Jefferson Academy of Science and Technology in Annandale (Virginia). This alone attests to the significant amount of work on some important parameters, without which the appearance of the plane could not be imagined.

According to reports in the press, the space plane, as it is sometimes called for short, is to be known as the X-31, but it also has another name that should make a great impression on the public--the "Orient Express," capable of covering the distance between Washington and Tokyo within minutes. On this basis, it was decided that the space plane would be the ideal vehicle for the transport of passengers and freight to countries in the Pacific basin; the exact flight time has not been calculated, but in any case, as the American press remarked, it will be the shortest of all the options available today.

The talk about the civilian use of the new plane, however, cannot conceal the fact that the Pentagon has expressed the greatest interest in its development, especially after the "Challenger" disaster. It is the Pentagon that is financing 90 percent of the project.

The space plane, which will take off from a conventional runway and will accelerate to 15-25 times the speed of sound, will be capable of breaking

through the atmosphere and entering a low orbit close to the earth. The latter will be achieved with the aid of a built-in rocket. All of this will make it a more universal, more effective and cheaper means of delivering people and cargo to space in comparison to single-flight spacecraft or the space shuttle. This is of paramount significance to the Pentagon.

According to experts, the main problem in creating the aerospace plane is connected with the development of an absolutely new type of engine.

This will be a supersonic ramjet internal-combustion engine. The combustion will take place in a current of air moving at supersonic speeds. The key to the technology of this engine is the use of hydrogen as fuel. Its combustion is not only quicker and more effective than that of hydrocarbon fuel, but also cools the engine and adjacent components. Jet engines operating on hydrocarbon fuel cannot accelerate to the speeds needed for the aerospace plane because they create high temperatures. These engines are used on some European rockets, but the United States has not used them. Lower temperatures make much higher flight speeds possible. The fundamentally new engines have been researched in Langley and other NASA research centers for almost 25 years. At first it seemed that engines of this type would never be used. After the government learned about the results of the research, however, a decision was made in 1985 at the insistence of the Pentagon on the stepped-up development of a hypersonic plane capable of taking off from a conventional runway, soaring into orbit and then landing on a conventional runway.

In the opinion of specialists, there are other major problems in addition to the development of a new engine, such as various fuel-cooling designs and technologies and the aerodynamics of the space plane. The President's National Commission on Space has recommended stepped-up research in the spheres of the propulsion systems, high-strength materials and other technologies needed for the aerospace plane.

The commission is headed by Doctor Thomas Paine, former NASA administrator. He has insisted on the acceleration of preliminary research and calculations for the quicker commencement of flight tests. An analysis of the possibility of developing a space plane, conducted last year, impressed NASA and the Pentagon and lies at the basis of their decision to start the second phase of the program this year--the development of the most important technologies. The announcement was made by Doctor Lee Beach, the assistant director in charge of aeronautics in NASA's Langley research center in Hampton (Virginia).

Estimates of budget allocations for the current phase of the project change rapidly. In February there was talk about 600 million dollars for the next 5 years, but now there are written references to this sum for the next 3 years, and only to cover research contracts in industry. The biggest slice of the pie will go to the military-industrial complex. Large aerospace companies, including Boeing, have created special engineering teams to work on the designs for the new vehicle and its most important components. A fair share will be demanded by McDonnell Douglas, one of the leaders in jet aircraft engineering, and by Rockwell, the main builder and assembler of the space shuttles. Fierce competition is expected to break out between General Electric and Pratt &

Whitney, a branch of the United Technologies Corporation, for the right to develop the components of the experimental engine, because they are the main producers of jet equipment.

The first contracts were mainly connected with engines and preliminary design. This is the usual practice: When airplanes and spaceships are being developed, the work begins with the engines and structural elements that will have to withstand unusually high temperatures, and all the rest is then adjusted to fit these initial designs.

It is the general opinion that the construction of the new plane will not be completed until 2000. The Pentagon, the main initiator of the program, worked for several years with some companies of the military-industrial complex, until the ideas of scientists and the military acquired tangible form in experiments, on drafting paper and in the abovementioned model for the President, with the inscription "U.S. Air Force" on its wings.

Why did the militarists take an interest in this project? The first reason cited by all analysts is the concern of the militarists, their old worries about the inability of the space shuttle to take off quickly, in contrast to the new hypersonic plane, which, in addition, can also put satellites in orbit and carry people and cargo to space stations as well as the space shuttle can. Here is what Air Force Major General Donald Kutyna, a member of the presidential commission for the investigation of the "Challenger" disaster, had to say: "The possibilities of transporting people, delivering cargo and conducting reconnaissance speak for themselves. And the prospect of creating such economical engines that there will be no need to spend money on the launching of rockets and shuttles is so important that it cannot be ignored."

The National Commission on Space was even able to calculate that the aerospace plane could reduce the cost of putting payloads in orbit to 200 dollars a pound, instead of the 4,000 dollars a pound for shuttle delivery.

Many experts feel that the civilian use of this plane is quite doubtful. At any rate, the matter will not be clarified before the end of the century. On the other hand, the possibility of using the plane to put nuclear weapons in orbit for Reagan's "Star Wars" is quite obvious; this was precisely the aspect of the matter that was underscored in the 17 February 1986 issue of TIME magazine. It said: "The development of hypersonic transport could have serious strategic aspects, but its commercial civilian use is highly doubtful."

Nevertheless, the cost of tickets for civilian passengers has been calculated. A flight from New York to London on the "Orient Express" will cost 3,000-4,000 dollars (2,500 on the supersonic Concorde). Americans can fly from the west coast to the east coast in 12 minutes, but they will pay about one and a half to two times as much.

This kind of plane could fly around the world in 120 minutes, and this time is based on a speed of Mach 25--that is, 25 times the speed of sound. According to some estimates, ramjet engines are already capable of operating at a speed of Mach 10-12. Maximum flight altitude could be several dozen kilometers.

An ordinary rocket or rocket engine will be required for the final stage, to enter orbit. Speeds of Mach 20 or more are being simulated on computers, but the ramjet engine can operate only at speeds exceeding Mach 6. This also creates the problem of combining different engines in a single system or of their sequential use.

One solution proposes that the initial use of oxygen as a fuel component and the subsequent use of hydrogen for supersonic speeds be combined in a single engine.

Journalists are analyzing the impact of the aerospace plane project on the future of the shuttle program. The Pentagon is requesting that a new spaceship be built to replace the one that exploded, for the completion of all previous plans connected with the space program, but this will cost from 2 to 3 billion dollars. The situation is complicated by the objections of many experts to further large investments in the program, because they believe that the shuttles are based on the somewhat outdated technology of the 1970's. Rumors in the American press about the complete cessation of shuttle flights sound like idle talk, and this is what Pentagon spokesmen have called them repeatedly. The engineers from NASA who are working on the X-31, however, admit that the lively discussions in the press about the new plane are naturally feeding the rumors about the elimination of the shuttle. The press is already calling the space plane the shuttle's potential successor.

The new program has aroused interest in connection with NASA's failures, when two rockets, a Titan and a Delta, exploded. There have been reports that the United States has supposedly lost all chance of putting new satellites in orbit and that this has reduced the Pentagon's reconnaissance capabilities. NASA's status as a leader in space technology has been shaken. In the X-31 program, the Pentagon has assumed full responsibility for administering the project, conducting tests and arranging for additional research; NASA has been charged with the development of technology. In essence, it is being transformed more and more from an independent agency into a scientific and technical appendage of the Air Force and other subdivisions of the Defense Department. The uncertainty of NASA's future is being discussed extensively in the American press.

There is also another aspect of the matter. The day after the President announced the aerospace plane project, the English government announced its plans to participate in financing the research and construction of a space plane which will be capable of horizontal takeoffs and landings at the same speeds as the X-31. France had already announced the development of the "son of the Concorde," with a flight speed almost double that of its "father"; its passenger capacity will also double. England and France once invested 4.3 billion dollars in the Concorde before it ever got off the ground, and this investment is far from recouped.

The British space plane is in the stage of preliminary design under the auspices of British Aerospace. The English government will allocate another 4 million dollars for research in the next 2 years. After the completion of the research, British Aerospace will ask the European Space Agency for

7 billion dollars. The English place, just as the American "Orient Express," is scheduled for completion at the end of the 1990's. A serious battle between the United States and Western Europe in the field of space plane engineering is anticipated. In 1971 the United States suddenly withdrew from the game and cancelled its project for a supersonic civilian aircraft. Now Washington is not doing this, because the X-31 is being developed primarily in pursuit of military goals.

This is precisely why many of the important details of the design, dimensions and characteristics of the aerospace plane are being kept strictly secret.

Technology is becoming increasingly complex and its development requires colossal scientific and industrial effort. But why is this being done? Is it being done so that the aerospace plane can fly around the world in 120 minutes or so that systems with nuclear weapons can be deployed in space?

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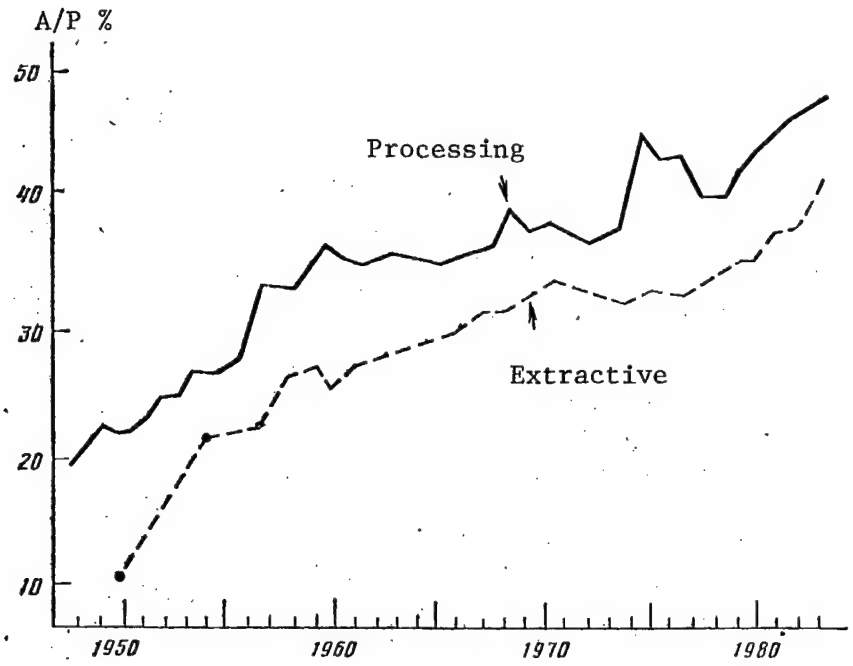
[Article by V. Ye. Khrutskiy: "Administrative Personnel in U.S. Industry"; passages rendered in all capital letters printed in boldface in source]

[Text] Increasing attention is being paid to the human factor in the process of the intensification of national production both in theory and in practice. Its increasing importance is connected primarily with the fact that the relative numbers of people engaged in mental and physical labor in the labor force are changing constantly and the labor force itself is becoming increasingly complex.

The relative number of workers engaged in mental labor in the labor force has risen quite quickly in the U.S. economy in recent years: from 48.4 to 54.4 percent between 1973 and 1983, exceeding the increase for the previous 10 years 1.5-fold.[1] The rising percentage of workers engaged primarily in mental labor is an objective law of the process of the intensification of production and an important factor of its heightened efficiency. As the percentage of live labor in production decreases, as the percentage of embodied labor increases,[2] as equipment becomes more complex and as the quantity of equipment used in production increases, more mental (engineering and administrative) labor has to be used. The percentage of engineering and technical personnel and administrative personnel in the total number employed is higher in the economic systems with a higher absolute level and growth rate of indicators of production efficiency and the quicker incorporation of scientific and technical achievements in production. The U.S. experience in economic development corroborates this statement.

Economists, however, generally ascribe the rising percentage of workers engaged in mental labor to the rapid development of the non-production sphere and branches of the infrastructure in the age of technological revolution. The same tendency, however, is clearly apparent in the sphere of physical production, including its main branch--industry. Here it takes the form of a change in the correlation between the number of administrative (A) and production (P) personnel, the form of a rise in the so-called coefficient of administrative intensity--A/P. It is calculated in percentages and indicates the number of administrative personnel per 100 production workers.



Dynamics of Administrative Intensity in U.S. Industry (1948-1983)

According to the classification system of the U.S. Bureau of Labor Statistics and the Census Bureau, the category of ADMINISTRATIVE personnel consists of executives and officials; specialists and technicians, including personnel engaged in R & D; office workers and trade personnel. All of these groups, with the exception of people engaged in industrial R & D,[3] are categorized as administrative personnel in our statistics. Production personnel, according to the American system of classification, are service personnel and workers with varying degrees of skill, including foremen.

The data on the number of administrative personnel for this survey were taken from the publications of the Bureau of Labor Statistics. They annually provide information about the total number employed and the number of production personnel in industry as a whole and in different branches. Special publications on the professional structure of the labor force cite indicators of the relative and absolute numbers of workers of different professions in these categories. Information about the number of people engaged in industrial R & D is published by the U.S. National Science Foundation. In general, statistics provide quite detailed information about changes in the professional composition of various labor groups, sectorial employment, professional training and other characteristics of the national labor force.

Dynamics of Administrative Intensity

The postwar dynamics of the A/P coefficient in the U.S. processing and extractive industries (see graph) testify that the increase in the number of

administrative personnel always exceeds the increase in production personnel. The A/P coefficient in the processing industry, for example, more than doubled between 1948 and 1983, rising from 20 to 47 percent. In the extractive industry it more than quadrupled, from 10.4 to 41 percent, between 1950 and 1983. The dynamics of administrative intensity are influenced by cyclical factors. During periods of economic recession, the number of production personnel is more apt to decline than the number of administrative personnel. This is indicated, in particular, by the fact that the A/P coefficient rises dramatically at the lowest point of the cycle and gradually declines during the recovery phase, although it remains above the pre-crisis level. The curve shows that the growth rates of administrative intensity in American industry slowed down in the 1960's and 1970's and began climbing in the 1980's. This is also indicated by the average annual A/P growth rates in the postwar decades (Table 1).

Table 1. Average Annual Growth Rates of Administrative Intensity in U.S. Industry

Sectors	1950's	1960's	1970's	1980's
Processing	1.6	0.1	0.5	1.4
Extractive	1.4	0.7	0.3	2.2

Calculated according to data in "Statistical Abstract of the United States" for the corresponding years (Section Labor Force).

In the processing industry the A/P growth rates were highest in the 1950's and much lower in the next two decades. In the extractive industry the tendency toward the slower growth of administrative intensity is even more apparent. The growth rate was reduced by half each decade since 1960. At the beginning of the 1980's, however, the A/P growth rates climbed dramatically (a 3-fold increase in the processing industry and more than a 7-fold increase in the extractive industry).

The most interesting thing, however, is that it was precisely at the beginning of the 1980's that leading U.S. industrial corporations undertook administrative personnel cuts on a scale unprecedented in the postwar period. There has been a reduction of administrative personnel by almost 500,000 in the last 5 years. According to the estimates of Professor E. Jennings (University of Michigan), 89 of the 100 top U.S. corporations reduced their total number of administrative personnel.[4]

Of course, there is no paradox here. First of all, various categories of employees are being reduced to differing extents; dismissals mainly affect the personnel of corporate headquarters. Secondly, the number of production personnel has been declining much more quickly than the number of administrative personnel in the 1980's.[5] The number of both administrative and production personnel in American industry decreased between 1980 and 1983 (Table 2): The first by 117,000 (or 2.5 percent), and the second by 1,686,000

(11 percent)--that is, in a ratio of 1:14. There was a corresponding rise in the level of administrative intensity (Table 3): from 42.7 to 47 percent in the processing industry and from 34.8 to 41.2 percent in the extractive industry.

Table 2. Number of Administrative and Production Personnel, in thousands

Branches	1980		1981		1982		1983	
	A	P	A	P	A	P	A	P
Industry	6486	15 653	6607	15 548	6541	14 329	6369	13 967
Electrical power engineering	150	677	155	695	166	708	174	708
Extractive	265	762	300	832	312	831	279	678
Processing	6071	14 214	6152	14 021	6063	12 790	5916	12 581
Food	533	1175	523	1151	511	1127	504	1118
Tobacco	15	54	16	54	15	53	17	52
Textile	111	737	111	712	107	643	103	641
Clothing	185	1079	185	1059	180	984	180	984
Woodworking	113	578	113	556	109	494	110	548
Furniture	90	376	91	376	80	343	92	355
Pulp and paper	170	523	170	518	169	493	167	495
Printing	553	699	568	698	571	698	586	710
Chemicals	481	626	480	627	478	601	466	581
Petroleum refining	73	125	81	135	81	120	77	118
Rubber	168	559	167	569	164	537	162	556
Leather	36	197	36	197	36	185	34	174
Construction materials	149	513	147	491	141	437	137	436
Metallurgy	264	878	260	861	238	684	213	625
Metalworking	418	1195	419	1173	401	1034	377	997
General machine building	892	1602	922	1585	899	1368	837	1201
Electrical machine building	763	1328	780	1312	799	1217	795	1229
Transport machine building	667	1233	677	1216	659	1085	653	1103
Instrument building	285	426	299	428	306	410	305	390
Other branches	105	313	107	304	107	279	103	268

Calculated according to data from "Statistical Abstract of the United States" for the corresponding years (Section Labor Force).

Therefore, the reorganization of administrative personnel in the country's leading firms (although it is the largest reorganization of the postwar period in the United States, it is far from the only one) is not simply a matter of the reduction of the relative number of engineering and technical personnel and administrative personnel in the total number employed and is not even lowering the growth rate of this indicator. In fact, it is more likely to do the opposite. The purpose of the reorganization of administrative systems and methods on all levels is the enhancement of the quality of administrative work, the efficiency of engineering labor and the performance of other categories of employees as scientific and technical achievements are used in production on an increasing scale, division of labor is intensified, the variety and complexity of economic contacts increase and the informational context of production grows. The attainment of this objective requires a relatively

greater number of administrative, and not production, personnel. A high level of administrative intensity has become an essential condition for heightened production efficiency. For a better understanding of this and of the mechanism of A/P growth, we will first examine how the level of A/P changes in different branches.

Table 3. Dynamics of Level of Administrative Intensity in Branches of Extractive and Processing Industries (1950-1983)

Branches	1950 г.	1960 г.	1970 г.	1980 г.	1981 г.	1982 г.	1983 г.
Processing	21,7	37,3	38,0	42,7	43,9	47,4	47,0
Food	34,5	49,4	48,5	45,4	45,4	45,3	45,1
Tobacco	8,4	13,7	20,3	27,8	29,6	28,3	32,7
Textile	7,4	11,5	14,0	15,1	15,6	16,6	16,1
Clothing	11,3	13,7	14,1	17,1	17,5	18,3	18,3
Woodworking	8,4	13,3	16,2	19,6	20,3	22,1	20,1
Furniture	14,8	20,1	21,4	23,9	24,2	23,3	25,9
Pulp and paper	16,6	24,7	30,0	32,5	32,8	34,3	33,7
Printing	51,4	62,1	62,5	79,1	81,4	81,8	82,5
Chemical	38,8	54,3	74,2	76,8	76,6	79,5	80,2
Petroleum refining	32,1	38,8	64,7	58,4	60,0	67,5	65,2
Rubber	23,4	27,7	30,9	30,0	29,3	30,5	29,1
Leather	11,3	12,9	17,2	18,3	18,3	19,5	19,5
Construction materials	15,6	24,0	25,7	29,0	29,9	32,3	31,4
Metallurgy	16,0	22,8	26,2	30,0	30,2	34,8	34,1
Metalworking	21,2	37,4	37,1	34,9	35,7	38,8	37,8
General machine building	30,2	40,7	49,8	55,7	58,2	65,7	69,7
Electrical machine building	28,7	41,0	51,5	57,4	59,4	65,6	64,7
Transport machine building	22,9	37,4	45,0	54,1	55,7	60,7	59,2
Instrument building	32,3	51,1	65,5	66,9	69,9	74,6	78,2
Extractive	10,4	24,9	31,7	34,8	36,1	37,5	41,2

Calculated according to data in "Statistical Abstract of the United States" for the corresponding years (Section Labor Force).

As the data in Table 3 illustrate, the A/P coefficient rose in all branches of the processing industry between 1950 and 1983. The differentiation of A/P coefficient levels in different branches, however, is striking. In 1983, the printing industry, the chemical industry and instrument building, with the highest level of administrative intensity (around 80 percent), outstripped the textile, clothing, woodworking and leather industries (with an A/P level ranging from 16 to 20 percent) by 4 or 5 times. It is indicative that the great difference in A/P levels displayed almost no change in the postwar period, and this also attests to the approximately equal rates of rise of the indicator in various branches.

This fact indicates that the rise of administrative intensity in the majority of branches in the postwar period was due to common objective causes: the rising level of production automation and mechanization and the reduction of manual labor. For example, the branches with the highest level of administrative intensity (over 60 percent) in 1982 and 1983 in addition to the three

listed above were petroleum refining, general and transport machine building and electrical machine building. These are branches with a high capital-labor ratio and power-labor ratio, high levels of production mechanization, continuous flowlines and so forth. The branches with an A/P level below 26 percent, on the other hand, included the textile, clothing, woodworking, leather and furniture industries. They are distinguished by a high percentage of manual labor and highly labor-intensive production.

The rise of administrative intensity is the result, on the one hand, of a relative decrease in the number of production personnel, because this labor is easier to replace with capital and energy, and on the other, of the use of more specialists, especially engineers and technicians, for the development, incorporation and adjustment of new highly productive equipment. Besides this, production requires administrative and organizational preparations. Major changes in equipment also presuppose the radical reorganization of labor organization methods and labor incentives and changes in production planning and sales, in the organizational structures of management and in the functions of personnel on various levels of the administrative hierarchy. This kind of reorganization is the function of administrative personnel, especially workers engaged in the technical and organizational support of production (engineers and technicians).

The process is complicated by the more extensive use of robots. According to the estimates of American experts, in this case the cost of personnel training, technological adjustments and the improvement of administration and labor organization could far exceed initial investments in the new equipment.[6] Without these expenditures, however, the potential of new machines and equipment to heighten production efficiency cannot be realized.

Therefore, the numerator of the indicator of administrative intensity can increase constantly while the denominator decreases (which was the case until the 1980's). The A/P indicator as a whole rises. Under the present conditions of the extensive incorporation of computers and new types of office equipment in the sphere of administrative labor, the rate of the replacement of live labor with embodied labor is rising even here. The intensification of administrative and engineering labor is accompanied by slight changes in the abovementioned mechanism of the growth of administrative intensity, but only the mechanism of growth, and not the tendency itself. There is an absolute decrease in the number of production personnel and of white-collar workers. The rates of decrease in the two categories, however, differ widely, as illustrated above. Furthermore, the absolute reduction in the number of administrative personnel is also connected with a macroeconomic tendency--the reduction of the absolute and relative number of people engaged in physical production during the process of the structural reorganization of the economy.

The widespread use of industrial robots leads to an unprecedented savings in live labor, especially physical labor. According to some estimates, by the year 2000 around 80 percent of all manual labor in the U.S. economy could be automated.[7] In this case the growth rate of administrative intensity will rise even higher. According to the data of American experts, by 1990 each 100 jobs created by the development of robot engineering will be distributed in the

following manner: 25-35 jobs for technicians, 17-20 for engineers, 9-11 for office workers and 11-13 for managers and other members of the administrative staff. The share of workers will not exceed 25-30 jobs.[8]

Changes in Administrative Personnel Structure

The reorganization of the administrative structure of U.S. industrial corporations at the beginning of the 1980's considerably changed the structure of engineering and technical personnel and employees. A better assessment of these changes calls for an analysis of the correlations of the main categories of administrative personnel during the postwar period in the processing industry (Table 4). It illustrates the structure of employees in American industry from two standpoints: the American system of classification (by the basic categories of employees) and the functions performed by various categories of personnel (with staff and line managerial personnel representing separate administrative groups). It must be said that several of the professional groups categorized as production personnel in the American system of classification (foremen, inspectors, timekeepers and others) perform administrative functions. Foremen, for example, supervise production workers, shops and production divisions (with a staff of up to 400 or more). Their labor, just as the labor of inspectors and timekeepers, is primarily of a mental nature. From this standpoint, they should be categorized as "white-collar workers." Service personnel (watchmen, janitors and security guards), who also work in the offices of industrial corporations, can hardly be included among administrative personnel (as is the case in our statistics)--that is, among workers engaged primarily in mental labor.

The group of LINE managerial personnel consists of managers on all levels of administration. Their functions consist in making decisions and supervising manpower. In American industry the group includes foremen as well as executives and officials. The group of STAFF administrative personnel, whose functions consist in the preparation and substantiation of decisions, the issuance of recommendations to managers, the processing of information and the technical and organization support of production, includes not only specialists, technicians, office workers (with the exception of group supervisors) and trade personnel, but also timekeepers and inspectors. It is understandable that the total number of line and staff administrative personnel is greater than the number of administrators in the American system of classification and the number of production personnel is lower (Table 4).

Changes in intraorganizational management in the late 1960's and 1970's had a direct effect on the administrative personnel structure in the American processing industry. The correlation between line and staff personnel changed considerably in comparison to the 1950's and 1960's. The ratio of engineering and technical personnel to the personnel of financial and sales offices changed within the staff personnel category. According to the data in Table 4, the relative number of top and mid-level management personnel in the total number of employees decreased by 10 percent between 1950 and 1970, but the figure rose 13.8 percent between 1970 and 1978. The percentage of line managerial personnel in general changed accordingly. The percentage of foremen, however, remained relatively stable in the 1970's. For this reason, top and middle management accounted for the higher percentage of line managerial

personnel in the total number of employees in the processing industry. The relative number of specialists and technicians stabilized in the 1970's, but it increased 1.6-fold between 1950 and 1970. The relative number of staff personnel displayed similar tendencies. The absolute decrease in the number of scientists and engineers in the processing industry is particularly significant. Whereas this group of administrative personnel was distinguished by rapid growth between 1950 and 1970--from 245,200 to 733,200 (almost tripling)--the figure dropped to 719,200 between 1970 and 1978.[9] There was a corresponding drop from 12.4 percent to 11 percent in the proportion accounted for by this category of administrative personnel in the total number of employees in the 1970's.

Changes in the developmental tendencies of the administrative personnel structure in the American processing industry are also illustrated by the discrepancy between the actual structure and the forecasted one. For example, the forecast of the Bureau of Labor Statistics for 1980 (Table 4) extrapolated tendencies of the previous decade in the numerical dynamics of various categories to the 1970's. A comparison of the forecast to the data for 1978 reveals that the anticipated decline in the percentage of line managerial personnel as a whole did not take place. There was no absolute increase in the number of scientists, engineers, office workers or all administrative personnel. The increased emphasis on the financial aspects of the operations of firms in the 1970's affected the number of people employed in bookkeeping and financial offices (an increase of approximately 1.5-fold). The number of qualified bookkeepers and auditors alone increased by 18.4 percent, whereas it had decreased by 5.3 percent between 1960 and 1970. Besides this, the labor of the personnel of financial offices is one of the spheres with the largest supply of mechanization and automation equipment. Most of the economists, statisticians, planning experts and systems analysts working in U.S. industrial corporations are primarily engaged in the analysis of the financial operations of firms. There was a 1.5-fold increase in the percentage of these employees in the total number of staff personnel at that time. The number of trade workers increased in the 1970's, whereas it had decreased in the previous decade. The total number of people engaged in the supply, marketing and sale of manufactured goods also rose (by 11,000), whereas it had decreased by almost 30,000 in previous years, attesting to the excessive growth of headquarters. The dramatic deceleration of the growth of the number of personnel office employees in industry was due to the reluctance of many companies to introduce new forms of labor organization and incentives in these years, the rising percentage of less skilled manpower (members of ethnic minorities and women) and the emphasis on technocratic approaches in the motivation of workers.

The stability of the percentage and the slight rise in the number of scientific and technical personnel (scientists, engineers and technicians engaged in R & D), on the one hand, and the decreasing percentage and number of those engaged in the technical maintenance of production (a 6.5-percent decrease between 1970 and 1978, in comparison to a 29.4-percent increase in the 1960's), on the other, indicate that the slower growth rate of production efficiency in the 1970's in comparison to the earlier period was connected less with the insufficient research potential of American industry than with the reluctance of the managers of many firms to institute the large-scale retooling of production.

Table 4. Dynamics of Structure and Number of Administrative Personnel in Processing Industry

	1950 г.		1960 г.		1970 г.		1978 г.		1980 г. *		1990 г. *	
		%		%		%		%		%		%
(1)	3697,2	100	5135	100	5920	100	6448	100	7590,5	100	7373,2	100
(2)	748,8	20,2	1002	19,5	1087,8	18,4	1348	19,8	1281,7	16,9	1558,7	21,1
(3)	764,4	20,7	1365,5	28	1952,8	33	2138,5	33,1	2765	36,5	2406,1	31,5
(4)	51,8	1,4	109,3	2,13	146,6	2,48	140,4	2,17	206,2	2,72	148,8	2,02
(5)	193,4	5,2	440,8	8,58	586,6	9,91	579,2	8,95	869,3	11,45	649,5	8,8
(6)	1116	46,4	2141,0	41,7	2409,3	40,7	2485,8	38,4	2892,8	38,2	2812,8	38,1
(7)	468	12,7	559	10,8	471,3	7,9	494,7	7,65	640,6	8,4	599,9	8,1
(8)	–	–	5877,5	100	6737,1	100	7391	100	8603,9	100	8436	100
(9)	–	–	1735,9	29,5	1892,9	28,1	2259,1	30,57	2299,6	26,7	2571,9	30,5
(10)	–	–	713	12,13	779,6	11,57	880,1	11,91	989,0	11,49	1013,2	13,7
(11)	–	–	3724,9	63,38	4346,9	64,52	4590,7	62,11	6304,4 **	73,2 **	5864,1 **	69,5 **
(12)	–	–	1504,8	25,6	1963,1	29,14	2135,8	28,9	8439,4 **	39,9 **	3084,4 **	36,55 **
(13)	–	–	2220,1	37,78	2383,8	35,38	2454,9	33,21	2865,0	83,3	2779,7	32,95
(14)												
(15)	–	–	535,2	9,11	692,6	10,28	650,2	8,8	1714,1 **	19,92 **	1232,8 **	14,6 **
(16)	–	–	308,1	5,24	320	4,75	480,3	6,5	352,6	4,1	538,5	6,4
(17)	–	–	830,7	14,13	801,2	11,89	812,1	10,99	1004,5	11,68	980,1	11,6
(18)	–	–	34,6	0,59	68,7	1,02	76,3	1,03	73,2	0,85	61,4	0,73
(19)	–	–	416,7	7,09	497,3	7,38	541,2	7,32	–	–	–	–

* Estimates of U.S. Bureau of Labor Statistics

** Including scientific and technical personnel

Source: "Gosudarstvo i upravleniye v SShA" [Government and Management in the United States], Moscow, 1985, pp 38-39; "The National Occupational Employment Matrix," Wash., 1981, vol 1.

Key:

1. Administrative personnel, American system of classification
2. Managers
3. Specialists and technicians
4. Scientists
5. Engineers
6. Office personnel
7. Trade personnel
8. Administrative personnel, functional system of classification
9. Line administrative personnel
10. Foremen
11. Staff administrative personnel
12. Staff specialists
13. Staff office personnel
14. Functional breakdown of staff personnel:
15. Technical maintenance
16. Accounting and finance
17. Supply and sales
18. Personnel divisions
19. Scientific and technical personnel

When changes in the administrative personnel structure between 1978 and 1990 are assessed, it should be borne in mind that the forecasts of the Bureau of

Labor Statistics (Table 4) in this case are also based on the extrapolation of tendencies of the 1970's and differ completely from the realities of the 1980's. The reorganization of administrative staffs of industrial firms at the beginning of the current decade brought about a major change. For example, according to forecasts, the number of administrative personnel should increase by 14.3 percent between 1978 and 1990 (that is, at the same rate as in the 1970's). By 1983, however, the number had already decreased by 500,000 in comparison to the 1978 figure (Table 2). In an atmosphere of fierce competition, leading U.S. companies are striving to maximize the intensification of administrative and engineering labor and the enhancement of its effectiveness. The economization on live labor in the administrative sphere under the influence of computerization is just beginning.

As for the structure of administrative personnel, our analysis revealed that it would not change in the ways predicted by the experts from the Bureau of Labor Statistics. The relative number of managerial personnel was supposed to rise from 19.8 to 21.1 percent by 1990 (Table 4). Corporations are making the largest personnel cuts, however, in precisely this group of employees. The number of middle level managers alone (heads of functional divisions and offices and their assistants) was cut at the beginning of the 1980's, from 20 percent in the Firestone and Crown Zellerbach companies to 40 percent in the Chrysler Corporation.[10] The need to heighten the independence and responsibility of production divisions and enterprises and of low-level management in general in the resolution of production problems required the elimination of many regulating, controlling, planning and analyzing links in corporate administrative systems, and the transfer of their functions to computers and to those directly engaged in the manufacturing process. The elimination of the authority of these offices was accompanied by the elimination of the corresponding members of top and middle management. This naturally affected the absolute and relative numbers of managers and of staff personnel and the personnel structure. According to the forecast for 1990, the number of personnel of financial, bookkeeping, supply and sales offices was supposed to increase by 226,000 and the number of trade personnel was supposed to increase by 100,000 (Table 4). In reality, however, the installation of computers in offices alone will cut sales personnel by an average of 60 percent.[11] The personnel of these offices were the first to be cut from the administrative staffs of the largest U.S. companies in the 1980's, as well as the personnel of planning, systems analysis and other divisions.

According to the forecast of the Bureau of Labor Statistics, the number of office personnel was supposed to increase between 1978 and 1990, but the percentage was to remain the same (Table 4). But the labor of these employees, who perform routine information processing operations, is easier to mechanize today than the labor of other categories of employees. As the intensification of the administrative sphere with new computerized equipment continues, the number of clerical workers will decrease much more quickly than the number of specialists. American experts have estimated that the use of voice-activated dictaphones and word processors alone will reduce the workload of today's office personnel by 50 percent.[12] But the replacement of the labor of office personnel and the rise in the capital-labor ratio are, however, lagging far behind the mechanization of the labor of production personnel. For this

reason, the proportion of office personnel in relation to production personnel will rise, but their functions and skills will be changed considerably by computerization.

Other categories of administrative personnel are being cut in corporate headquarters. For example, Chrysler reduced the staff of its engineering offices by 4,000 without any adverse effect on new model design programs.[13] Cuts in the number of engineers, however, are still being conducted on a lesser scale than the reduction of other administrative staff categories. We should not forget that the redistribution of functions among various levels of management during the reorganization of the 1980's was accompanied not only by the dismissal of employees, but also by the redistribution of personnel among various subdivisions. Corporate executives are in no hurry to lose the administrative personnel of headquarters and the most highly qualified personnel. Engineers and other specialists in fields of technology and production make production subdivisions stronger. And the dismissed managers and specialists from other staff offices find jobs in the consulting business. It is precisely to these powerful and specialized consulting and marketing firms, which are completely self-funded, that many American corporations are now assigning the functions of their reduced planning, systems analysis and other staffs. This is more economical than keeping a highly paid specialist on the administrative staff. The existence of this intense flow of administrative personnel is attested to by data on the rate of unemployment in this category. In January 1983 it rose to 4.4 percent (the highest rate of the postwar period) and then it rapidly declined to the usual rate for the given phase of the economic cycle--2.8 percent in August 1985.[14]

Analysis indicates that the reduction of the administrative personnel of American industrial firms is not a goal in itself, but simply one of the means of heightening the effectiveness of administration and production in general. The widespread of automated equipment in administration is also a method of heightening the efficiency and improving the quality of management, and not simply a means of reducing the number of administrative personnel. The computerization of management is usually instituted by the firms in which traditional means of enhancing the productivity of mental labor have been exhausted, and in which the technical and organizational development of production requires fundamentally new systems and methods of management. For this reason, whereas the number of administrative personnel is decreasing here, administrative intensity rises in these systems, because the labor of production personnel is replaced to a much greater extent than the labor of engineering and technical personnel and employees by mechanization and automation equipment. From the standpoint of production efficiency, the postwar development of American industry has demonstrated that a higher A/P coefficient and a higher percentage of engineering and technical personnel and employees in the total number employed are objectively necessary. This is a natural law, a long-term tendency which grows more pronounced even under the conditions of the intensification of the administrative sphere itself. The role of workers engaged primarily in mental labor in the phase of intensive economic growth, when the higher productivity of embodied labor is the main factor contributing to production efficiency, constantly grows more important because the role of science, management and the organization of labor play an increasingly

important role in the development of society's productive forces. This is why the growth rate of the percentage of administrative personnel in the total number employed is constantly rising as the intensification of industrial production progresses and the structural reorganization of the economy is accelerated. Without these changes in the professional structure of manpower, the accelerated retooling of industrial production and the long-term enhancement of efficiency are impossible.

The intensification of production also requires changes in the structure of administrative personnel. The experience of the United States has proved that there must be a lower percentage of line managerial personnel, especially in top and middle management, and a higher percentage of staff personnel, particularly specialists. The number of workers engaged in the technical maintenance of production (engineers, designers and technicians) must rise more quickly than the number of other staff personnel groups. These workers, by virtue of their social status and, what is most important, their place in the system of society's productive forces in the current stage of the technological revolution, are part of the proletariat. Within the near future, as statistics indicate, engineering and technical personnel will become the main object of capitalist exploitation and the largest segment of the industrial proletariat in the high-technology sector and in other branches. Most of the workers in traditional occupations (fitters, welders, lathe operators and others) will be replaced by robots and flexible automated production systems. The labor of those engaged in mental work, on the other hand, the engineers, technicians, trade personnel and office employees who can operate personal computers and other highly complex automated systems, is already turning into the main source of surplus value.

FOOTNOTES

1. SSHA: EPI, 1985, No 9, p 54.
2. In the U.S. processing industry, for example, the percentage of live labor decreased from 30 to 15 percent in the last 30 years (INDUSTRY WEEK, 29 October 1983, p 36).
3. They represent just over 7 percent of the administrative personnel in the U.S. processing industry.
4. FORTUNE, 28 October 1985, p 46.
5. Only 30 percent of the 24,000 jobs eliminated in the information systems division of the AT&T Corporation were white-collar jobs (FORTUNE, 28 October 1985, p 46).
6. INDUSTRY WEEK, 29 October 1984, p 33.
7. SSHA: EPI, 1985, No 9, pp 51-52.
8. USINE NOUVELLE, 7 July 1983, p 64.

9. The dramatic increase in the number of scientists and engineers in 1978 neutralized the general tendency of the 1970's to some extent.

10. BUSINESS WEEK, 25 April 1983, p 36.

11. "Gosudarstvo i upravleniye v SShA," p 211.

12. Ibid., p 212.

13. BUSINESS WEEK, 25 April 1983, p 37.

14. FORTUNE, 28 October 1985, p 52.

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U.S. MILITARY INTEREST IN ERGONOMICS

Moscow SSHA: EKONOMIKA, POLITIKA, IDEOLOGIYA in Russian No 10, Oct 86 (signed to press 15 Sep 86) pp 93-103

[Article by V. M. Munipov: "Ergonomics (Technology and the Human Factor)"; passages rendered in all capital letters printed in boldface in source]

[Text] Ergonomics has reached a high level of development as a field of science and a sphere of practical activity. It is the comprehensive study of the natural laws governing man's interaction with technology, with the object of his activity and with his environment during the process of his attainment of certain goals or during vocational training. It is simultaneously a scientific and planning discipline because its functions include the comprehensive analysis of data on the physical and psychophysiological capabilities of the human being during the development of technology and the creation of the corresponding labor conditions.

The term "human factors" is used in the United States to refer to the special field of knowledge and sphere of professional activity known as ergonomics in Europe. Recently, however, there have been more frequent appeals for the replacement of this term with the conventional one. Ergonomics in the United States, including engineering psychology, is one of the behavioral sciences.

The development of ergonomics in the United States is connected primarily with the introduction of technical and technological innovations. Experts in this field are often consulted when acute problems arise in industry. The heightened intensification of labor causes stress among workers, an increase in industrial accidents and occupational diseases, the dramatic decline of interest in work and, in many cases, an aversion for work. Firms and companies expressing an interest in ergonomics hope to improve the quality of industrial production by using the research findings of this scientific discipline.

The most important premise lying at the basis of ergonomics, as American scientist D. Meister remarked, is simple to the extreme and consists in the assumption that people influence the effectiveness of everything they do and everything with which they interact. Systems served by people--military, commercial, industrial and social--must be designed in such a way, the American scientist stressed, that personnel can manage them effectively, safely and without excessive stress.

The increasing militarization of the economy and the rapid development of military technology have made the Pentagon the main source of funds for ergonomic projects. In the 1980's they were included in the overall expansion of military R & D scales. American experts have mentioned several reasons for the Defense Department's heightened interest in this kind of R & D. The first is the dramatically heightened technical complexity of military equipment and the corresponding rise in personnel requirements. Today's army, however, cannot afford to hire only the most capable personnel for the performance of the much more complex jobs. This is why it is necessary either to reduce the technical complexity of equipment (which would be extremely difficult to do) or to enhance the capabilities of personnel by means of the ergonomic design of equipment--that is, by making it easier to operate and maintain. The second reason is the shortage of competent personnel. Systems which are easier to operate and maintain require fewer people and a shorter training period. This is one of the main concerns of military organizations. The third reason is the cost of maintaining personnel, which now represents 60 percent of all departmental expenditures.

The leading centers of "human factors" research in the United States are subidivisions created under the auspices and at the expense of the military-industrial complex and the aerospace industry. Some Defense Department laboratories specialize either exclusively in ergonomic research or, as engineering laboratories (for example, the Navy's oceanographic center in San Diego), have a group of specialists in ergonomics on their staff to work with other engineering groups.

The use of the results of ergonomic research in the development and operation of military equipment can enhance its effectiveness considerably with the simultaneous reduction of the quantity of equipment and maintenance personnel (and, consequently, expenditures). At one of the annual conferences of the Human Factors Society, American scientist R. Peterson asked the rhetorical question: "How would the military organizations financing us get along without the support of ergonomics?" And he then added: "And how would ergonomics get along without military support?" This is precisely what D. Meister had in mind when he remarked that the colossal sums spent on the development of ergonomics in the United States give its research brilliance and scope unparalleled in other capitalist countries.[1] Scientists and specialists in the United States are the leaders in the R & D conducted since 1967 as part of the NATO "human factors" program.[2]

A committee on "human factors," chaired by MIT Professor T. Sheridan, was set up by the U.S. National Research Council for the development of theoretical and experimental research. The committee's functions include a further increase in the number of theoretical and methodological publications, recommendations on more advanced basic research and the recruitment of scientists in various fields for this work.

The committee members are 13 leading specialists in ergonomics. Its activities are financed by the Office of Naval Research, the Army Institute of Research in the Behavioral and Social Sciences, the Research Office of the Air Force, NASA and the National Science Foundation.[3]

The need for the more thorough analysis of the problems arising literally at each step in the work of specialists is being felt acutely in ergonomics. For example, D. Meister singles out the following problems: 1) the definition of personnel requirements for the maintenance of a new system by extrapolating the characteristics of existing equipment; 2) the translation of personnel requirements into parameters of the system design process; 3) the forecasting of personnel capabilities and performance in the projected system; 4) the assessment of labor intensity; 5) the development of methods of estimating the degree to which changes in design or in the professional training of personnel can reduce the probability of human error; 6) the use of the results of performance analysis in specific equipment design operations or in hiring and training practices; 7) the determination of the number and qualifications of specialists needed for the projected system.

These are examples of the general problems that are being investigated by scientists in military and civilian fields. It is sometimes quite difficult to separate military and civilian R & D into specific fields of ergonomics, and the division is almost always a conditional one: Many military standards are later used in civilian industry.

The development of ergonomics in civilian fields is lagging far behind its development in the military-industrial complex. Even in civilian industry, however, its achievements are quite impressive. American scientist A. Imada has directed attention to the fact that the development of technology has made the sphere of activity of the expert on "human factors" extremely broad. In addition to the traditional military and space branches, it now encompasses industrial systems, personal and public land transport, information display systems and equipment, public and residential buildings, communication systems, consumer goods, etc. Ergonomics is promoting the enhancement of efficiency, safety and comfort.[4]

Many American companies have large ergonomics subdivisions (Bell Systems, IBM, Martin-Marietta and others). The many years of operational experience of the ergonomics division of the Eastman Kodak company, for example, were reflected in the basic work "Ergonomic Design for People at Work."[5]

The problems of ergonomic research in specific fields are discussed below: information equipment, robot engineering and flexible production systems, aerospace design, nuclear power plant operation, etc.

Information Equipment

The R & D aimed at the resolution of the ergonomic problems of broad-scale COMPUTERIZATION, the development of personal computers and computer networks of various types, have acquired great scope. To some extent, this is connected with the fact that the tension resulting from the speed of the computer and the anticipation of breakdowns in the system cause stress in the users of computers. Many programs are poorly adapted for dialogue with the human being.

Ergonomic research and development projects have been undertaken in the United States to answer the question of how the best conditions for man's

effective use of computers can be established. There is the impression, American specialists have remarked, that computer systems are designed for the convenience of the designer, and not the user. More and more basic research is aimed at revealing the natural laws governing man's interaction with the computer. The principles of this interaction are being worked out on the basis of general systems theory.[6]

Various human-computer communication media are being researched in the United States, including input media with punch-cards and magnetic cards, keyboards and a special magnetic reader. The effects of their structural features on the efficiency and ease of work with these media are analyzed.

The number of studies connected with the evaluation of the working conditions of people working with display units is constantly rising. Until recently the display units were developed primarily on the basis of technical and economic criteria. Studies of the health and working conditions of the people working with them revealed a high rate of eyestrain, accompanied by headaches and backaches. The reason for the latter was that operators had to retain a certain posture to read the information on the display screen quickly and accurately. Publications in the United States have reported that work with display units can cause various eye disorders and other occupational diseases.

The National Institute of Public Health and Occupation Disease of the United States recommends that certain characteristics be taken into account in work with display units, such as screen flicker, the brightness of the background and letters, the sharpness of symbols, lighting, glare (especially from the screen), the dimensions of the workplace (including keyboard and screen height, screen angle, leg room, ceiling height and others), the radiation and noice levels of the operating unit and others.[7] A survey published in 1984 essentially coincides with the national institute's recommendations: Of the 83 studies conducted, 28 were on visual discomfort, 21 were on letter and number outlines, 16 were on the consideration of anthropological and biomechanical data in the organization of workplaces and the design of keyboards, 9 were on the organization of work, 9 were on lighting and glare.[8]

Whereas the machine was the primary consideration in the first 35 years of the computer's existence, American scientist B. Schneiderman remarks, now attention is being directed to the work of the human. Current objectives are easy operation, simple training, increased reliability, less frequent errors and heightened user satisfaction. In Schneiderman's opinion, all of this "can be achieved only through the comprehension of the capabilities of perception, its ability to process information and make decisions, and through the knowledge of the style of thinking and characteristics of the individual. These characteristics should be analyzed during the process of human labor with a view to machine-imposed limitations."[9]

Many studies have established that systems incompatible with the user's ability to digest information can lead to informational overload or underload and to stress. The idea of "user-friendly" systems--that is, systems maximally adapted to the human--is being substantiated in American literature on information systems and computers. This means that the language of the system

should be easy to understand. It should react quickly and relieve the user of unnecessary operations, learn as much as it can about the user and help him instead of manipulating him.

Until recently, American scientist A. Kay points out, user interface (software) was the last part of the computer system to be developed. Now it is of paramount importance because the computer, both for novices and for professional experts, is precisely what the person can perceive with his own senses. The ability to give the user the appropriate instructions and advice is the main feature of optimal user interface. Attempts are now being made to develop the kind of interface that would make operating a computer easier to learn than driving a car.[10]

Studies of artificial intelligence software have been conducted for more than 30 years in the United States. The main fields of research concern systems comprehending natural language, machine vision and expert systems. All of them have their own distinctive features and represent different tasks in ergonomics. According to American scientist E. Shortliff, several questions arise during the creation of expert systems--in medicine, for example: Is the system reliable, can it be used easily, is its advice dogmatic, and does the physician using it feel comfortable enough?[11]

In the middle of the 1970's the researchers of artificial intelligence, remarks Stanford University specialist in information engineering D. Lanat, reached the following fundamental conclusion: The knowledge people acquire as something that seems self-evident must be gradually "fed" to the machine. This is why programs representing "experts" in strictly specialized fields have the greatest success. The key to solving problems with the aid of artificial intelligence lies in reducing the choice of options in the search for solutions. To this end, the program must realize the same principles used in human mental processes.[12]

American and English scientists have developed an experimental model of an expert system in the field of ergonomics, allowing for the input of the appropriate data during the earliest stage of project planning. A general program of 70 theories effectively describing the field of ergonomics has been compiled.[13]

One section of Schneiderman's book has a title that is quite interesting and reflects the basic thesis of the entire work--"Develop Computers That Will Behave Like Instruments." In other words, although computers can work with knowledge, they cannot create it. "I maintain," he stresses, "that in time, and even as we build increasingly complex computer systems, the difference between man's creative abilities and the instrumental nature of the computer will become increasingly obvious. We will see what kind of jobs we should turn over to machines. We will see even more clearly that computers are only instruments operating under man's control, and that they are no more intelligent than a pencil."[14]

Analyzing the problems and procedures connected with the use of computers in pre-launch verification and control operations in the lunar landing program

for the manned Apollo spacecraft, American scientists arrived at a seemingly obvious conclusion of considerable scientific and practical interest. The contemporary information revolution and the spread of computers, they decided, are raising new basic ergonomic problems, including the question of the distribution of functions between man and machine. A significant fact, which is ignored too often by the designers of systems and is disregarded when these decisions are made, is that computers are not responsible for what they do.

Putting all of the potential of the computer to work for man, A. Kay stresses, will necessitate the attainment of computer literacy by non-professional users and an ergonomic approach to their training.

Robots and Flexible Production Systems

Applied ergonomics, in the opinion of American scientists, should be adapted to new forms of automation, included ROBOT ENGINEERING. Research is supposed to tell how man's interaction with the robot should be organized to make their joint work more efficient. Special attention is given to the design of robots, the procedures of their use, the safety of working with them and the distribution of functions between man and robot. There are nine types of human activity that will probably be present in any system including robots: observation, intervention, service, duplication, insertion, withdrawal, direction, control, and the joint performance of actions by man and robot in the production process.[15]

The largest number of such projects has been conducted by the departments of the Army, Air Force and Navy. Army ergonomic laboratories, for example, are studying the possibility of using robots for the loading of artillery weapons and for the on-base repair of heavy-duty vehicles. An Air Force laboratory is working on a program for the use of remote-control instruments in work with nuclear devices. The existing engineering approach, which was considering the use of remote-control instruments to replace human labor, was severely criticized as a result. According to scientists, equipment controlled from a distance cannot replace man but can only enhance his operational capabilities.

The design of robot engineering complexes includes the objects of ergonomic research--control panels, including display units, control instruments and alarms. Ergonomic recommendations are needed in the organization of workplaces in production units with robot engineering complexes. Questions connected with the vocational training of workers are just as significant, including standby training in the event of robot breakdowns when the absence of a standby operator would result in substantial production losses.

One sign of the increased interest of robot engineering experts in ergonomics was the organization of the special technical committee on "human factors" in the robot engineering division of the International Organization of Industrial Engineers. Special discussion groups on ergonomics are organized at the annual symposiums of the committee.[16] The interaction of working people and robots is to be observed to study not only the results of their joint work, but also the people's attitude toward the robots, their satisfaction with their work and a number of organizational aspects.[17]

Research in robot engineering aids in a better understanding of some aspects of the human's work. For example, IBM is analyzing the assembly of a device to feed paper into a copying machine, which consisted of 27 different parts and presented certain difficulties for robotized assembly. After the item was redesigned, the number of parts was reduced to 14, 13 of which are assembled by a robot and 1 by the human operator. This considerably simplified the manual assembly. Paradoxically, American scientists point out, we know more about what robots need than what people need.[18]

The number of ergonomic R & D projects connected with the creation and maintenance of flexible production systems is rising in the United States. The distribution of functions between man and machine in the system, the capabilities and characteristics of the person managing the system, the processes of the registration and processing of information derived from the observation of its functioning and other aspects of the system are being studied.[19]

Aviation and Space Ergonomics

AVIATION AND SPACE ergonomics has been developed extensively in the United States. Technical progress in aviation offers fundamentally new opportunities for the resolution of traditional ergonomic problems. In addition, the modern technical equipment in cockpits and air traffic control systems give rise to an entire group of complex problems of this type. The results of research conducted by NASA and other organizations indicated that human error is one of the main causes of air accidents and disasters. Pilots are increasingly likely to suffer from hypertension, which American physicians have called the leader among the medical disorders in this profession. The primary reason is the highly responsible job of the pilot and the neuropsychological stress it causes. Examples of various air accidents and errors recorded in some studies illustrate and underscore the following statement: "As systems are automated and become more complex, they become more vulnerable to human error. The problem can be eliminated or reduced only if human factors are taken fully into account in the design of systems, to guarantee the good interaction of man and machine."[20]

Virtually all projects in the design and use of aviation equipment and air traffic control systems include ergonomic subprograms. Quite often, however, airplanes are still built with an obvious disregard for ergonomic requirements. In the state of Virginia, for example, one newspaper reported that the U.S. Air Force needs pilots of a specific build: with long arms and short legs, so that they can fit into cockpits. And these were the pilots who were hired. The explanation for this odd news item is that the U.S. Air Force is still using planes designed without regard for existing ergonomic standards.[21]

Air disasters stimulate the development of aerospace ergonomics. After a Boeing-727 collided with a Cessna-172 near San Diego in September 1978, there were loud public appeals, as newspapers reported, to "do something."

The companies and firms developing aircraft and air traffic control systems usually have many ergonomists on their staffs. For example, 45 such experts work for Lockheed and participate in the design of rockets and space and

ground systems. The company has developed standards, defining the ergonomic aspects of human-computer communication, which are used by designers and programmers. A computerized dummy has been built to solve ergonomic problems: the design and evaluation of the field of vision and accessibility of control instruments in cockpits, the definition of normal or acceptable work postures and the simulation of the operations of crew members. The dummy is part of Lockheed's integral system of machine design and production.[22]

The birth of microprocessor technology created the need to determine how the automation of a particular function performed by the crew in flight would affects its operations in general. This was the topic of a special NASA study. It was also discussed at a joint seminar for NASA and industrial organizations, where the advantages of automation, its desirable volume and other matters were investigated. The main problems mentioned at the seminar were false alarms and their effect on crew behavior, the pilot's confidence in instrument readings, the need to improve information display systems and their use, the use of equipment in unforeseen situations, the creation of systems to diagnose possible errors, and professional training. It was reported that the use of the results of these discussions was not confined to aviation alone.[23]

Ergonomic research is defining the entire content of designs in more and more projects. The goal is a computerized "intelligent cockpit." Until recently, with few exceptions, attempts to use computers in aircraft equipment were confined, according to American scientists J. Hammer and W. Rose, to the installation of various cybernetic devices for the performance of specific functions. The result of this approach "from the bottom up" was the tendency to strive for partial success and lose sight of the main goal: giving pilots the maximum benefits of computerization. Scientists have proposed a general theory and program of aircraft computerization based on the analysis of in-flight crew behavior. A model of crew operations lies at the basis of the program. This is a "thinking" control system in the sense that it does not merely simplify the work of crew members but can also make independent decisions. According to its initiators, this could put an end to the practice of "cramming" as many computerized devices as possible into a plane, many of which duplicate one another's functions, and could improve cockpit equipment considerably.[24]

The scales and speed of the development of air traffic do not correspond to the through capacity of modern air traffic control systems. Research methods allowing for the simultaneous study of many interacting factors under the actual conditions of the work of pilots and controllers and the functioning of computers are being developed too slowly, in the opinion of experts. Research programs in several U.S. universities are supposed to correct this lag.

The development of aviation ergonomics has also been stimulated by problems in space flight. In Rochester, J. Loftus, an american specialist from NASA, presented a report on "Human Factors in Two Generations of Manned Space Flights" at the 25th annual conference of the American Human Factors Society. He stressed that the improvement of flight programs in the United States and

the USSR on the basis of ergonomic research would secure the more efficient performance of functions by astronauts.[25]

A series of ergonomic research projects connected with the development and operation of the space shuttle is being conducted. Special simulation models are being built for this purpose.

Ergonomics and Nuclear Power Plants

After the accident at the American Three Mile Island nuclear power plant in 1979, one of the main causes of which was the disregard for ergonomic requirements in the design of the plant and in the organization of the work of its personnel, more attention was paid to the analysis of the state of control points in NUCLEAR POWER PLANTS. This plant was designed on the basis of technical and economic criteria assigning preference to automatic equipment and limiting the behavior of human operators. As a result, the necessary conditions were not established for the reliable and effective work of personnel in emergency situations. Furthermore, personnel had not been given sufficient training in emergency procedures. When the accident occurred, 1,300 alarms went off and lit up the control panel in the first 30 minutes. The operators, who were in a state of stress and realized that they might not be able to leave the plant, were incapable of immediately finding the malfunctioning unit and compounded the accident with their behavior. The American scientists and specialists who analyzed the causes of the accident and then surveyed other nuclear power plants concluded that the effectiveness of equipment operation should be secured in the design with consideration for ERGONOMIC requirements.[26]

Prior to the accident, enterprises of the nuclear industry were not equipped in accordance with ergonomic recommendations. For this reason, instructions based on military standards and general recommendations were recently issued to designers. It is true that not all of the instructions apply directly to nuclear plant control systems. Nevertheless, the ergonomic design expertise in the military and space spheres is being used more extensively in design and construction projects in the nuclear industry. Recommendations are being drafted for the ergonomic improvement of the control panels of nuclear plants.[27] The Essex firm was contracted by the Atomic Safety Office of the Energy Department in 1984 to work on a project with the aim of determining the spheres in which ergonomic data could be used to heighten the safety of equipment in nuclear plants and reduce the possibility of human error.[28] The diagnosis of malfunctions is being given considerable attention in U.S. nuclear power engineering.

Operation of Technical Equipment

The ergonomic design of "man-machine" systems is connected with PROFESSIONAL training and hiring. It is a common misconception, however, that professional training allegedly has nothing to do with the design of equipment, as D. Meister has pointed out. It is completely obvious, however, that the performance of specific operations, which are determined by the characteristics of equipment (or a system) and its design in general, require certain skills.[29]

Ergonomic studies of the structural adaptability of systems for technical maintenance (the accessibility and arrangement of checkpoints, built-in testing devices, cable color codes and so forth) are acquiring increasing significance. Technical maintenance adaptability is the result of the design of equipment in such a way as to facilitate the performance of repairs and preventive procedures.

Scientists have directed attention to a gap in the ergonomic study of defect detection, which is connected with the shortage of information about the way in which the technical specialist registers, remembers and reproduces information about equipment breakdowns. As a rule, attention is focused on the results of defect detection, whereas it is the entire process that must be controlled.

A computerized model of the aviation maintenance technician is being developed by the U.S. Air Force. It helps the designer reproduce the technician's interaction with the system during maintenance on a computerized drawing board. The model reflects the exact dimensions and proportions of the technician's body and indicates difficulties connected with clothing and protective gear, the limitations of some work postures, maximum arm reach and instrument accessibility, and the strength the person requires to perform various operations. The model also helps the designer see difficulties connected with the visual detection of malfunctions. All of these problems were usually revealed only during the stage of life-size models, when it was too late to make changes in design. The reason was that no one ever attached primary significance to the problems of repair and maintenance.[30]

The increased production of computers in the United States and their increasing complexity have led to the substantial growth of expenditures on maintenance, which is connected with the ineffective diagnosis of breakdowns. Scientists have proposed several alternative diagnostic systems. One solution is automatic testing equipment, which will completely automate the search for malfunctioning units. This equipment itself, however, could give rise to additional difficulties in its maintenance, and in some cases it would be even more complex than the equipment it would be testing.

Specialists in ergonomics have taken an active part in the development of training equipment reproducing the functioning of existing "man-machine" systems in operation. This equipment is exceptionally important in professional training. Large sets of training equipment are quite expensive. The equipment used to train Boeing-747 pilots and the U.S. Air Force's pilot training equipment cost millions.

Personnel Training

The increasing number of higher academic institutions offering majors in ergonomics and the higher level of instruction have been instrumental in the development of this sphere of scientific and practical endeavor. An international handbook of academic institutions offering courses in ergonomics contains information about 156 academic programs in ergonomics in higher academic institutions in 28 countries. The United States had the greatest number--66 programs--as early as 1980.[31]

Each year the number of specialists with degrees in this field rises. According to data cited by American scientist G. Salvendi in 1982 at the 8th congress of the International Ergonomics Association, there was 1 ergonomist for every 350 engineers in the United States.[32]

The thorough investigation of problems in ergonomic education is being continued. The need for a stronger engineering background has been underscored. In addition, the study of computer software is an important part of this training. Since programs determine the structure of work with computers, ergonomists must be trained, in the opinion of American scientists, as computer analysts, so that new programs developed with their assistance will be ergonomically sound--that is, will be based on an understanding of the mental processes, decisionmaking methods, information processing capabilities and individual characteristics of users.

The Human Factors Society, which is promoting the development of studies of man's interaction with machines and the environment, the exchange of expertise and its use in practice, is playing an important role in the enhancement of the skills of specialists.

Not all of the fields of ergonomic research and development are covered in this article. The author has concentrated on the spheres of technical progress in which U.S. ergonomists have had the greatest success or anticipate significant advances in the future. In the opinion of D. Meister, the main problems requiring resolution today are social and technical. Scientific and technical potential, he goes on to say, has reached a high level. Its further development, however, is being impeded more and more by unresolved and almost insurmountable problems for designers in connection with human behavior in the technical system.

FOOTNOTES

1. D. Meister, "Behavioral Research and Government Policy. Civilian and Military R & D," N.Y., 1981, p 67.

2. ERGONOMICS, 1984, No 8, pp 833-845.

3. Ibid., 1985, No 4, pp 700-701.

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8. "Human Factors Review, 1984," Santa Monica (Calif.), 1984.

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10. V MIRE NAUKI, 1984, No 11, p 13.

11. "Designing for Human-Computer Communication," edited by M. Sime and M. Coombs, London, 1983, pp 209-238.

12. V MIRE NAUKI, 1984, No 11, p 112.

13. "Ergonomics International 85...," pp 130-132.

14. B. Schneiderman, Op. cit., p 269.

15. HUMAN FACTORS, 1982, No 5, pp 535-552.

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21. ERGONOMICS, 1985, No 8, p 1179.

22. "Ergonomics International 85...," pp 826-828.

23. ERGONOMICS, 1983, No 10, pp 953-961.

24. "Proceedings of International Conference on Cybernetics and Society, Seattle, 28-30 October 1982," N.Y., 1982.

25. APPLIED ERGONOMICS, 1982, No 1, pp 73-74.

26. Ibid., 1982, No 3, pp 177-189.

27. "Ergonomics International 85...," pp 406-408.

28. "New Frontiers for Science and Technology...," vol 1, pp 198-199.

29. D. Meister, Op. cit., pp 199-200.

30. "Ergonomics International 85...," pp 442-444.

31. ERGONOMICS, 1980, No 8, pp 806-808.

32. Ibid., 1982, No 6, p 445.

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AMERICAN BOOK ON ROLE OF HOTLINE IN CRISIS MANAGEMENT

Moscow SSHA: EKONOMIKA, POLITIKA, IDEOLOGIYA in Russian No 10, Oct 86 (signed to press 15 Sep 86) pp 104-106

[Review by A. A. Arzumanov of book "Beyond the Hotline. How Crisis Control Can Prevent Nuclear War" by William Ury, Boston, Houghton Mifflin Company, 1985, XIII + 187 pages]

[Text] William Ury, a well-known writer in the United States and abroad, is the author of books and reports on methods of resolving various types of conflicts, including international conflicts. Specialists in this field are usually called conflictologists. The author of this book, which investigates ways of resolving international conflicts, believes that "today crisis control offers the most promising way of reducing the danger of nuclear war" (p 4).

"We live in a world of crises," he writes (p 3). It would be difficult to argue with this. This is why the question of measures to avert or resolve crises is particularly important in the nuclear age.

"No leader of sound mind," Ury says, "will deliberately start a nuclear conflict, because it can lead only to a crushing retaliatory strike. This would be tantamount to national suicide" (p 4). But a war could start as a result of a miscalculation at a time of severe crisis, a lack of communication between governments, human error, organizational confusion and so forth. One human error often leads to another. The hasty decision of one side to escalate hostilities to protect its own interests will evoke a reaction from the other side, and this will escalate the conflict even more. Policymakers could lose control of events at some point in the "action-reaction" cycle. Then the outbreak of war will not be too improbable.

Analyzing the ways in which crises start and escalate, Ury says that in addition to the deliberate creation of a crisis situation, there is the danger that powers can be drawn into a conflict against their will. This could be a case of regional conflicts, nuclear terrorism directed against the USSR or the United States or accidental nuclear explosions with technical causes. "The mounting danger of the accidental outbreak of war is having a great impact on the policy of the Soviet Union and the United States," the author states (p 30).

Defining the crisis situation, Ury remarks that each government experiences its own difficulties and has its own plan of action in any situation of this kind. He does, however, single out four invariable features of the crisis that are common and equally dangerous to all of the parties involved: vital interests, crucial time limits, a high level of uncertainty and a limited number of obvious options. "These four factors," the author stresses, "are present to a different extent in all serious international crises; the more acute the crisis, the stronger their influence will be. In combination, they lead to a situation in which even experienced statesmen are often incapable of predicting the future and, consequently, of forestalling events. Working simultaneously, they cause the 'distortion' of the decisionmaking process, as a result of which a seemingly intelligent decision can produce a result contrary to common sense" (p 40).

The combination of these factors requires policymakers to take immediate steps. This is precisely why, the author stresses, a crisis control mechanism is so necessary.

The decisive spur to begin developing this mechanism, Ury writes, was provided by the Caribbean crisis of 1962, and it was soon afterward that the hotline between Moscow and Washington was installed. This was followed by a series of agreements, which the author also categorizes as direct steps toward crisis resolution. These were the agreements on measures to reduce the danger of nuclear war of 1971 and on the prevention of incidents in the open seas and the airspace above them of 1972, the basic principles of U.S.-Soviet relations of 1972, the agreement on the prevention of nuclear war of 1973 and the agreement on confidence-building measures in Europe. Finally, an agreement was signed in 1984 on measures to improve the hotline. The author calls this "an important step toward a crisis control system for the nuclear age" (p 53).

Ury advocates the creation of a joint Soviet-American crisis control center to work out the details of the system and to put it in action. This would go beyond the hotline and promote constant and direct interaction by specially trained diplomats and officials.

The author says that this center should have two branches--in Moscow and Washington--and that the capitals should be connected by telephone, computers, duplicating equipment and an audiovisual network. He also makes more specific proposals: the appointment of eight Americans and four Soviets to the Washington branch and of eight Soviets and four Americans to the Moscow branch. All staffers should meet regularly with the officials and working groups of their own government agencies. The constant rotation of these teams from Washington to Moscow and back is also suggested. "The hotline is simply not enough," the author stresses. "This is an exceptionally important instrument, but it suffers from serious defects.... There is no substitute for personal contact, in which an important role is played by personal characteristics--emotions, personality dynamics and the gestures accompanying words. Furthermore, communication will be even more productive if the people on both sides know each other, have worked together and have prepared individually and collectively precise for situations of this kind" (p 63).

The center the author proposes would represent not only "first aid," but also a preventive body, securing the regular investigation and control of friction in intergovernmental relations and guaranteeing that no early warning signal will be ignored.

In the author's opinion, the resolution of technical problems would be of great significance. Trained staffers from both countries who are used to working with each other could quickly work out the technical details of action together as soon as the leaders of their countries make decisions.

Besides this, center staffers could play a substantial role in the reinforcement of public trust. The unauthorized use of nuclear weapons and confusion could give rise to panic throughout the world. At a time like this, it is extremely important to show the public that the two great powers are working together to relieve tension. The center would play an even greater role, Ury writes, than the hotline if people knew that Americans and Soviets were working together to avert war.

The author feels that the creation of this center would be an extremely important step toward stronger Soviet-American cooperation and would clear the air of suspicion.

Ury proposes several other measures to prevent crises and control them. The author believes, for example, that in addition to the measures stipulated in the Soviet-American Agreement on the Prevention of Nuclear War, regular consultations on crisis control on the ministerial level would be desirable. Security procedures agreed upon in advance, he stresses, could reduce uncertainty, aid in establishing quick and reliable communications and secure a choice of means of averting war.

There is no question that the issues discussed in Ury's book are pertinent. His actual proposals, however, obviously require thorough examination by specialists.

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CHINESE-AMERICANS TRAINING SPECIALISTS FOR PRC

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[Article by V. I. Biryukov]

[Text] During the more than 100 years of the Chinese-American community's development, a disproportionately large substratum of the scientific and technical intelligentsia has taken shape among the American huaqiao.[1] This has taken place under the conditions of the rigid economic, political and racial restrictions imposed by the American society. The "exclusionary laws" (a group of anti-Chinese laws passed during different stages of Chinese immigration to the United States), which were in effect from 1882 to 1965, were intended to keep unskilled labor and members of the petty bourgeoisie out of America. These restrictions did not, however, extend to scientists, technical specialists and students. Scientific activity has traditionally been regarded in China as a prestigious occupation. The ancient Chinese tradition which, according to B. Sung, an American researcher of the problems of "Chinatowns," "endowed the scholar or educated man with high prestige"[2] in the social sense, was reinforced by the conditions of life in the American society and was fully reflected in the life of the Chinese community. According to the 1970 census, 48,000 highly qualified Chinese specialists were living in the United States at that time. They include three main categories: specialists in the exact and natural sciences (12,500), workers in education (10,000) and workers in public health (8,000).[3]

The situation in the 1980's is not known yet because the data of censuses in the Chinese community are processed by private individuals and public organizations, and this takes several years. We can already assume, however, that since the official number of people of Chinese origin in the United States almost doubled--from 437,000 in 1970 to 806,000 in 1980,[4] the number with a higher education also doubled and could be as high as 100,000.

People of Chinese origin now play a perceptible role in American science and education, especially in the locations of the highest concentration of Chinese, particularly California, where one-third of the 4 million Asian-Americans were living in 1983. The following indicators provide some idea of the scales and prospects of Asians, including Chinese, in American science and education: Although Asian-Americans represented only 5.5 percent of the

population of California in 1982, they represented 22.7 percent of the student body of the University of California in Berkeley. In a center for the training of American scientists and researchers as prestigious as the California Institute of Technology, 16 percent of the freshmen were of Asian origin.

The number of Chinese scientists and specialists is also being constantly augmented by students from Taiwan, the majority of whom do not return to their native land. Only 1,300, or 6.5 percent of the 22,300 students from Taiwan in the United States between 1950 and 1969, returned to their own land after graduation.[5] Therefore, the Chinese community has a considerable number of highly qualified scientific, engineering and technical personnel. Virtually every large scientific center and industrial firm in the United States employs Chinese-American specialists.

The role of Chinese-Americans in other natural sciences, such as nuclear physics, thermodynamics, semiconductor physics, theoretical and applied mathematics, ballistics, space research, astrogeology, high polymer chemistry and computer engineering, is particularly impressive. Several hundred Chinese are members of the U.S. scientific elite and are engaged in teaching and research in American scientific centers or occupy important positions (as advisers, chief engineers and leading specialists) in government agencies and private companies. They can be found near the world's largest elementary particle accelerator (designed and built by Deng Changli), in the radiation center of the University of Oregon (Director Qi Wang) and in the nuclear physics department of Columbia University (Chen Ning Yang, winner of the Nobel Prize in 1957).

Chinese-Americans head research projects in the laboratories of Grumman Aircraft Engineering, North-American, General Electric, Monsanto, Boeing, Lockheed, United Technologies, IBM and other Pentagon contractors. Chinese names can be found on the lists of the top personnel of space and chemical laboratories and of Defense Department experts and advisers.

Under the present conditions of diplomatic relations and American-Chinese agreements on scientific and technical cooperation, the Chinese-Americans have become active participants in the Chinese program of "Four Modernizations," particularly in the training of scientific and technical personnel. A large group of huaqiao scientists traveled to China to engage directly in this work. Under their influence, an increase in allocations for basic research in the natural and applied sciences is envisaged for the scientific and technical aspects of this program.

Many Chinese scientists living in the United States have done much to provide the PRC with scientific and technical information and to organize joint scientific projects in the United States and in the PRC, where their services are enlisted as experts in the organization of research and as instructors in higher academic institutions. Scientists of Chinese origin, who are of value to Beijing as middlemen and advisers in the efforts to expand scientific and technical relations between the two countries, took control of the training of Chinese specialists and students in American universities in 1978.

Several immigrant organizations have been founded in the United States since the end of the 1970's with the aim of assisting China in various undertakings. They have also helped to strengthen Beijing's influence in the huaqiao community. For example, the American-Chinese Committee for the Promotion of Scientific and Technical Relations, founded in Virginia by Doctor Li Zhenpiang, has played a perceptible role in the development of American-Chinese contacts in science, education and technology. The committee has concentrated on such fields of science as astronomy, chemistry, electronics, power engineering, machine building, mathematics, oceanography and physics.

The All-American Association of Chinese-Americans, founded by Chen Ning Yang in 1977, is still active. It unites members of the Chinese-American scientific and technical intelligentsia. Many of its members have made several 3-month trips to the PRC for direct participation in the training of scientific and technical personnel and for joint educational and scientific work with Chinese scientists.

As American-Chinese intergovernmental relations developed, Beijing began to use the scientific and technical potential of the Chinese community in the United States more actively. It initiated the training of specialists in the industrial firms founded jointly by the PRC and Americans of Chinese origin. When Ronald Reagan addressed representatives of various Chinese organizations in the National Assembly building in Beijing on 27 April 1984, he said that "around 50 Chinese companies have opened agencies or branches in the United States, and China has invested its funds in several joint enterprises in our country."

The PRC's huaqiao partners who own the firms played an important role in this process. For example, the Chinese Corporation for the Economic Development of Tianjin and Magnum International, a firm in San Jose (California), founded a joint company, American Industrial Technology, for the production of computer chips. The Chinese firm invested a million dollars in the construction of the company's plant in Vacaville, not far from San Francisco, and owns 45 percent of its stock. Four of the eight members of the board of directors are citizens of the PRC. The company intends to hire 200-300 blue- and white-collar workers, 20 of whom will come from the PRC every 6 months to learn more about the production of electronic components.[6] Another characteristic example of the increasing role of Chinese-Americans in the training of scientific and technical personnel for the PRC is the cooperation between the Santec Corporation in Amherst (New Hampshire), which produces computer printers, and the Nangking Telecommunications Corporation. The chairman of the board and president of Santec, Jeffrey Chuan Chu, first went to the PRC in 1978, where he presented lectures on computers in establishments of the Chinese Academy of Sciences. In 1979 the Chinese authorites restored his right to his family fortune of millions, although it cannot be taken out of the PRC. He presented 660,000 dollars to Jiaotong University in Shanghai to finance post-graduate courses in management. He also organized an exchange program, in accordance with which American professors from the University of Pennsylvania are teaching in Jiaotong University. In 1980 he was received by Deng Xiaoping. During the meeting he convinced the Chinese leader of the need to master administrative methods. "Building computers is not the main thing,"[7] he said.

In 1983 Santec and the Nangking company agreed that China would send the American firm six trainees a year. Three Chinese were already working for the firm in the first half of 1984, participating in the design of power equipment and learning about other aspects of production.[8]

Jeffrey Chuan Chu is a good example of the role of Chinese-Americans in the provision of the PRC with scientific and technical personnel and modern American technology.

These methods were also used in another joint company--the Pearl River cannery (Clive, Iowa). It was founded by China Native Products, based in New York's Chinatown, and the Guangdong Food Corporation. President Chen Min'yi and Vice President Hou Chanping of the New York company invited five specialists from the PRC to work in Iowa.[9]

Chinese specialists are being trained in the same manner in the first Chinese-American joint enterprise, the Kelly firm, which builds highways, ports and other large facilities in the PRC and several other Asian countries.[10]

Another new form of cooperation is being used in the sphere of American-Chinese scientific, technical, trade and economic relations. At the end of 1984 China signed an agreement with Hofstra University on Long Island, New York, on the establishment of a special corporation for the solicitation and development of contacts with small and medium American companies wishing to sell their products in the PRC or to organize joint enterprises there. The university faculty includes many Chinese. The agreement was signed on the Chinese side by the PRC Scientific and Technical Society.[11]

The training of Chinese specialists and students in American higher academic institutions is an important way in which the potential of the Chinese community is being used for the training of personnel for the PRC.

In 1978 the Chinese Government decided to send young people to study abroad. Between 1978 and 1984 there were 32,500 Chinese students in 54 countries; there were almost 20,000 at the beginning of 1985; 14,000 have already completed their training and have returned to China. In addition to the 26,000 students whose training was financed by the Chinese Government (103 million dollars), another 7,000 paid for their own education abroad or were supported by huaqiao relatives.[12]

There are no exact U.S. statistics of the number of Chinese students and scholars being trained in American academic institutions. According to prominent American expert on PRC demographic patterns L. Orleans, "the State Department has ceased to keep records of the number of students from the PRC." "Our only source of information of this kind," declared L. Reed from the Foreign Students Association, "is the number of visas issued by our consulates." For this reason, American data on the number of Chinese students are not exact and range from 9,000 to 13,000.[13]

According to estimates, 5,000 students and 1,000 specialists with a higher education had attended 160 American VUZ's on PRC government scholarships and

3,000-4,000 students had undergone training at their own expense or at the expense of huaqiao relatives by the beginning of 1984. The majority of Chinese scholarship students majored in the exact and engineering sciences; 35 percent majored in liberal arts. Chinese students are concentrated mainly in California, New York, Wisconsin, Pennsylvania and Massachusetts. According to L. Orleans, more than half of all the Chinese students attending educational institutions outside the PRC on government scholarships and more than 80 percent of those financing their own education abroad were attending American universities during this period.[14] Of course, the existence of the Chinese community in the United States was an important factor. "The importance of the large Chinese communities in many American cities," L. Orleans believes, "cannot be overestimated. They attract all Chinese students, especially those wishing to pay for their own education and those with relatives and friends in the United States."[15]

Therefore, the Chinese community is also important in another capacity: It finances the education of many Chinese students. This source of funds appeals to the PRC leadership. It was no coincidence that the former head of the liaison mission, Chai Zemin, asked Chinese-Americans to "give students from the PRC maximum assistance in their studies and life" when he addressed Beijing's supporters in San Francisco's Chinatown in 1978, when the program of personnel training for the PRC in the United States was still in its initial stages.[16]

This led to the appearance of a large substratum of U.S.-trained scientists in education and science in the PRC. By 1962 there were 282 people who had been educated in America in establishments of the PRC Academy of Sciences and in VUZ's. One of the graduates of American VUZ's (89 in all) was the vice president of the Academy of Sciences and others were university chancellors, directors of scientific centers and deans of schools. Furthermore, 45 of the 125 directors of scientific research institutes, 85 of the 246 professors and 18 of the 47 VUZ vice-chancellors had studied in the United States. There were at least 1,600 highly qualified engineers and scientists in the PRC who had been educated in the United States.[17]

In its China policy, the United States has traditionally been motivated by a desire to infiltrate the educational system as an indirect method of channeling sociopolitical processes in directions benefiting the United States. The director of the Harvard Institute of International Development, D. Perkins, an expert on Chinese affairs, declared that "the 10,000 or more Chinese now studying science and engineering in the United States might be more important to us than any export of licenses."[18]

The Chinese community in the United States is not only assisting Beijing in its plans to raise the scientific and technical level in the Chinese economy. Chinese neighborhoods are still the arena of a fierce political and ideological battle between the supporters and opponents of the PRC. The Chinese students in the United States become directly involved in this political conflict, and this leads to the loss of some students who do not return to the PRC.

At the same time, the American authorities are suspicious of the activities of Chinese specialists and students in the United States. For example, back in 1979 the Lockheed corporation distributed a secret memo to the executives of its subdivisions in cooperation with the FBI to recommend the stoppage of "information leaks" to China.[19] According to NEWSWEEK, "the need to keep an eye on the Chinese is one of the reasons that the Reagan Administration wants to augment the FBI staff by 175 members next year--the first large increase since 1971. Another sign of the importance attached to China is that the head of FBI counterintelligence is an expert on Chinese affairs."[20] One CIA report accused China of trying to use any opportunity to acquire American industrial and scientific secrets for use in its military modernization project.[21]

Some arrests of Chinese individuals suspected of illegal activity for the benefit of the PRC have recently been reported. For example, a citizen of Hong Kong was arrested in San Francisco in 1984 and was accused of trying to smuggle secret computer components into the PRC. Several days later five people were detained in New Jersey after they tried to buy 14 pieces of equipment for subsequent delivery to China.

A new wave of "spy-hunting" seized the United States in 1985. Three people connected, according to the LOS ANGELES TIMES, with the PRC were arrested and accused of espionage.[22] Even the highest legislative body in the United States has been seized by spy-mania. In a letter to President Reagan, Senator J. Glenn accused China of violating the Export Control Act.

Official Washington is encouraging the training of scientific and technical personnel for the PRC with a view to its long-range goal of influencing the Chinese society in the U.S. interest. There are also signs, however, of increased suspicion of the activities of Chinese specialists, students and others in America. This ambiguous approach reflects the complex and contradictory nature of American-Chinese relations.

In general, however, the Chinese community in the United States is performing an important unofficial function in the training of scientific and technical personnel for the PRC and in the transfer of large quantities of scientific and technical information to that country.

FOOTNOTES

1. This is the Chinese name for all overseas Chinese, who are further divided into emigrants, or Chinese nationals living abroad, foreigners of Chinese origin (if they are citizens of foreign countries), and descendants of Chinese. It is virtually impossible, however, to draw precise distinctions between all of the people of Chinese origin living in the United States on the basis of these characteristics. According to official Chinese estimates, there were 20 million people of the Chinese nationality living in different parts of the world by the beginning of 1985 (FAR EASTERN ECONOMIC REVIEW, 22 November 1984, p 46).

2. B. Sung, "Chinese-American Manpower and Employment," N.Y., 1975, p 114.

3. Ibid., pp 114-115.

4. "Statistical Abstract of the United States 1985," Wash., 1985, p 31. Official statistics are not very reliable. For example, when former U.S. Vice-President W. Mondale was in Beijing in August 1979, he mentioned the "more than 2 million U.S. citizens of Chinese origin." In other words, people of Chinese origin would seem to represent half of all the immigrants from Asia (THE NEW YORK TIMES, 1 September 1979).

5. AMERASIA JOURNAL, 1973, vol 2, No 3, p 77.

6. THE CHINA BUSINESS REVIEW, September-October 1984, p 39.

7. THE WALL STREET JOURNAL, 7 July 1983.

8. THE CHINA BUSINESS REVIEW, September-October 1984, p 43.

9. Ibid., p 40.

10. China also plans to organize some joint companies and make large capital investments in Canada, where a Chinese community already exists.

11. THE NEW YORK TIMES, 9 December 1984.

12. CHINA EXCHANGE NEWS, March 1985, p 28; THE CHINA BUSINESS REVIEW, March-April 1984, p 6.

13. THE CHINA BUSINESS REVIEW, March-April 1984, pp 6-7.

14. Ibid., p 6.

15. Ibid.

16. MEIZHOU HUAQIAO RIBAO, 9 December 1978.

17. S. Shantanov, "Chinese Students in the United States," in the anthology "Natsionalisticheskaya politika gruppy Mao Tszeduna i SShA" [The Nationalist Policy of the Mao Zedong Group and the United States], Moscow, 1968, pp 150, 148.

18. "United States-China Relations: Today's Realities and Prospects for the Future. Hearing...U.S. Senate, 17 May 1984," Wash., 1984, p 56.

19. OCA IMAGE, The Newsletter of the Organization of Chinese-Americans, 1979, vol 6, No 4.

20. NEWSWEEK, 5 September 1983, p 38.

21. "Allocation of Resources in the Soviet Union and China--1982," Wash., 1983, p 114.

22. THE LOS ANGELES TIMES, 15 December 1985.